AECOM Environment

Submitted to:
Green Energy Partners/Stonewall LLC
Hamilton, VA

Submitted by:
AECOM
Chelmsford, MA
60248935
July 2012

Stonewall Energy Project
Air Quality Dispersion Modeling Protocol

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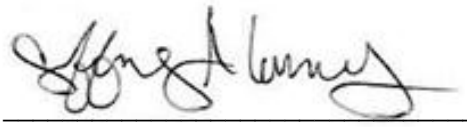
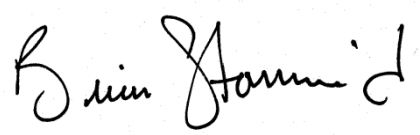


Prepared By Jeffrey Connors



Reviewed By Brian Stormwind

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1.0 Introduction

1.1 Project Overview

Green Energy Partners/Stonewall LLC is proposing to construct a new natural gas-fired combined cycle power station located in Loudoun County, Virginia, herein referred to as the "Stonewall Energy Project" or "Project". The proposed Project would be located on an approximate 101-acre parcel south-southeast of the Town of Leesburg Airport and north of the Dulles Toll Road in a rural area of Loudoun County. Green Energy Partners/Stonewall LLC is applying for a Prevention of Significant Deterioration (PSD) permit from the Virginia Department of Environmental Quality (VA DEQ) that will allow for the construction and operation of a "two-on-one" combination of either two General Electric 7FA.05 (GE 7FA.05) or Siemens SGT6 5000F5 (SGT6-5000F5) combustion turbines (CTs) paired with a single steam turbine. The Project will have a net generation capacity of approximately 750 MW at 92 ºF with maximum duct firing and evaporative cooling. Details of the auxiliary equipment being proposed are presented in **Section 2**. A copy of the United States Geographic Survey (USGS) topographic map showing the site location is also presented in **Section 2** of this document.

1.2 Purpose of Modeling Protocol

The purpose of this document is to present the proposed methodology for both PSD Class I and Class II area air dispersion modeling analyses that will be performed in support of the air permit application for the Stonewall Energy Project. Modeling methods and assumptions, including model selection and options, meteorological data and preliminary source parameters to be used in the modeling analyses, are presented in this document for review and approval by VA DEQ.

1.3 Contents of the Modeling Protocol

This protocol document consists of seven sections. **Section 1** provides an introductory presentation. **Section 2** contains a project description, including information regarding the plant's equipment, location and the expected air pollutant emissions. **Sections 3 - 5** present a detailed description of the modeling approach proposed to be used in evaluating air quality impacts of the proposed Project including model selection criteria, Good Engineering Practice (GEP) stack height determination, refined modeling analyses, ambient air quality compliance, and additional impacts analyses. **Section 6** presents the description of the result analysis that will be submitted to VA DEQ in support of the PSD permit application. **Section 7** documents the references that were used in preparing this document.

Appendix A contains the preliminary site plans of the plant. **Appendix B** contains the 30-years of monthly precipitation data from Washington Dulles Airport for use in the land use determinations when processing the model-ready meteorological data. **Appendix C** includes the AQRV waiver from the National Park Service, United States Forest Service, and Fish and Wildlife Service. **Appendix D** contains the site-specific adjustment to land use for AERSURFACE Modeling.

2.0 Project Description

This section describes several aspects of the proposed Project that are relevant for the proposed air quality modeling analysis.

2.1 New Generating Station Location and Layout

The proposed Project will be constructed on an approximate 101-acre parcel located south-southeast of the Town of Leesburg Airport and north of the Dulles Toll Road in a rural area of Loudoun County. A topographical map of the site region is shown in **Figure 2-1**. A preliminary site plan for the generating station, showing the plant property and adjacent roadways, is presented in **Appendix A**.

2.2 Process Description and Major Facility Components

The following section provides an overview of the Project to be described in greater detail in the permit application. The proposed plant is a combined-cycle power plant to be located in Loudoun County, Virginia. Green Energy Partners/Stonewall LLC is applying for an air quality permit that will allow for the construction and operation of a "two-on-one" combination of either two GE 7FA.05 or two Siemens SGT6-5000F5 combustion turbine generators and associated duct burners paired with a single steam turbine. The turbines and duct burners plant will be fueled by pipeline-quality natural gas only. The auxiliary equipment being proposed is listed below:

- Two 650 MMBtu/hr supplementary fired Heat Recovery Steam Generators (HRSGs) for the GE 7FA.05 – one for each CTG ; or, two 450 MMBtu/hr supplementary fired HRSGs for the SGT6-5000F5 option – one for each CTG;
- One reheat condensing steam turbine generator (STG);
- One 75 MMBtu/hr natural gas fired auxiliary boiler;
- One 20 MMBtu/hr natural gas fired fuel gas heater;
- One 2088 bhp emergency diesel generator operating on ultra low sulfur diesel fuel;
- One 330 bhp emergency fire-water pump operating on ultra low sulfur diesel fuel; and
- One 187,400gpm, 10-cell mechanical-draft cooling tower with drift eliminators.

The Project is proposed to be located in an area designated nonattainment for the 8-hour ozone NAAQS (moderate) and the 24-hour $PM_{2.5}$ NAAQS. The area was recently proposed to be designated as attainment for the $PM_{2.5}$ NAAQS but the final determination has not been made, therefore, $PM_{2.5}$ has been treated as both an attainment and a non-attainment pollutant. Based on preliminary emissions calculations, the proposed Project will be subject to PSD review for carbon monoxide (CO), nitrogen dioxide (NO_2), particulate matter less than or equal to ten microns (10 µm) in diameter (PM_{10}), particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$), and volatile organic compounds (VOC). Due to the Project's location in an area designated nonattainment for the 24-hour $PM_{2.5}$ and ozone, the Project will also be subject to nonattainment New Source Review (NANSR) for NO_X and VOC (for Siemens turbines only). The proposed Project will not be subject to NANSR for $PM_{2.5}$ because the proposed emissions will be less than 100 TPY, however modeling for $PM_{2.5}$ will be conducted in a manner consistent with other pollutants subject to PSD review for this project. The proposed Project is not expected to be a major source of hazardous air pollutants nor subject to PSD review for sulfur dioxide (SO_2), sulfuric acid mist (H_2SO_4) or lead (Pb).

The primary sources of pollutants associated with the proposed Project are the two natural gas-fired CTGs each equipped with supplementary fired HRSGs. There is no backup diesel fuel planned for the CTGs. Other potential sources of criteria pollutants associated with the proposed Project include the auxiliary equipment listed above. A brief description of the major components of the proposed Project is provided in the following sections. For this Project, AECOM proposes to conduct an air dispersion modeling analysis for the CTGs (including the HRSGs), auxiliary boiler, diesel-fired emergency generator, diesel-fired fire water pump, fuel gas heater, and cooling tower.

2.2.1 Combustion Turbines

The proposed Project includes the installation of either two GE 7FA.05 or SGT6-5000F5 natural gas-fired turbines in combined-cycle mode, each equipped with its own duct-fired HRSG and a common steam turbine generator. The combined-cycle turbines will be fired by pipeline natural gas. No restriction on the annual operation of each combined-cycle combustion turbine is expected (8,760 hours/year/turbine). It is expected that the combustion turbine will fire natural gas with the duct burning in the HRSG up to 1,400 hours/year and fire natural gas without the duct burning in the HRSG for the remaining 7,360 hours/year. Each turbine power block will include an advanced firing temperature combustion turbine air compressor section, gas combustion system (utilizing dry, low NO_x combustors), power turbine, and a generator.

2.2.2 Heat Recovery Steam Generators (HRSG)

A horizontal, natural circulation, three-pressure level HRSG system will extract heat from the exhaust of each proposed combined-cycle gas turbine. Steam production in the HRSGs will be augmented using duct burners that will be fired by natural gas only. The heat recovered is used in the combined-cycle plant for additional steam generation and natural gas/feedwater heating. Each HRSG will include a high-pressure superheater, high-pressure evaporator, high-pressure economizer, reheat section (to reheat partially expanded steam), intermediate-pressure superheater, intermediate-pressure evaporator, intermediate-pressure economizer, low-pressure superheater, low-pressure evaporator, and low-pressure economizer. Selective Catalytic Reduction (SCR) and Oxidation Catalysts will be installed in the HRSG exhaust system to control NO_x and CO and VOC, respectively.

2.2.3 Steam Turbine

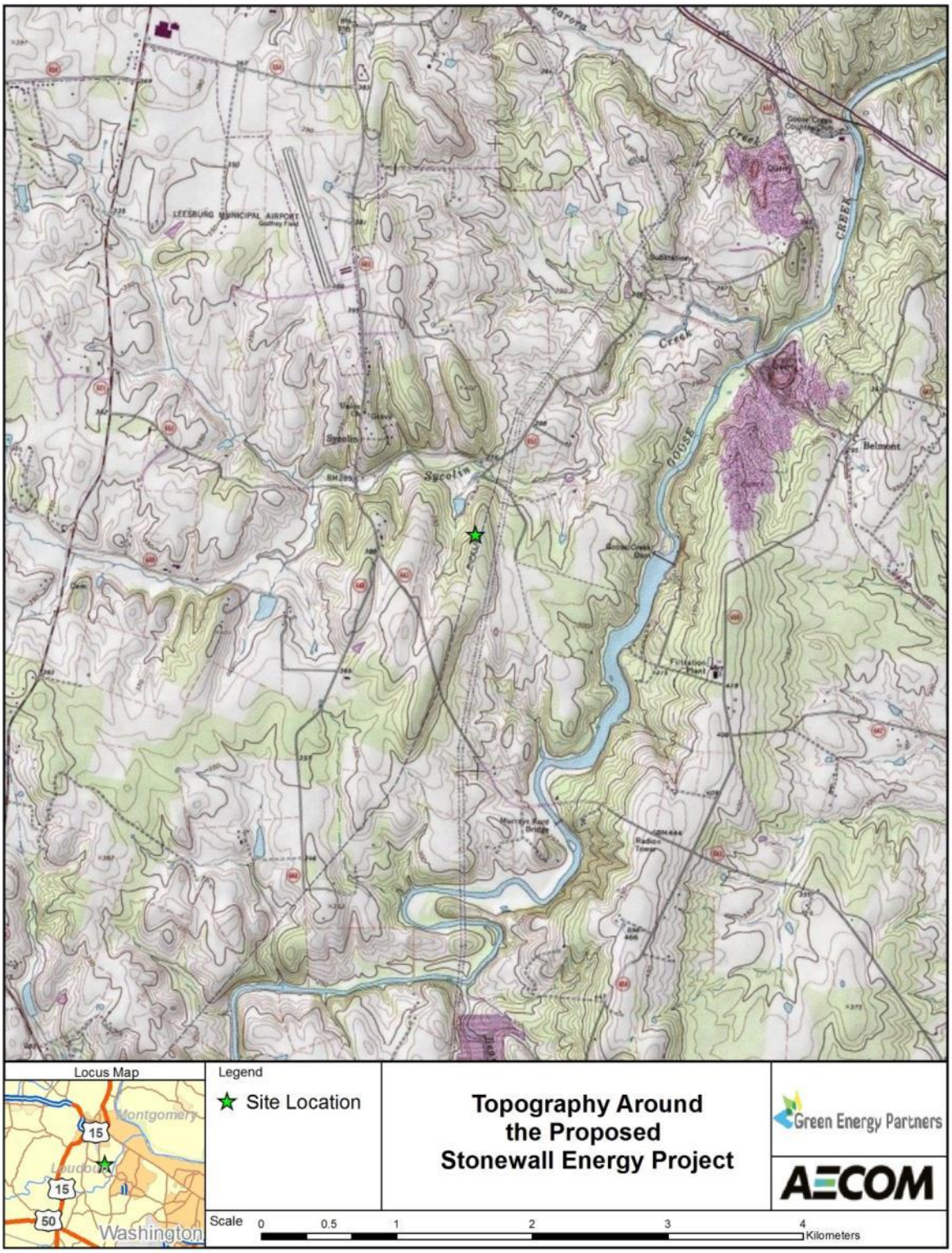
The proposed Project includes one reheat, condensing steam turbine designed for variable pressure operation. The high-pressure portion of the steam turbine receives high-pressure super-heated steam from the HRSGs, and exhausts to the reheat section for the HRSGs. The steam from the reheat section for the HRSGs is supplied to the intermediate-pressure section of the turbine, which expands to the low-pressure section. The low-pressure turbine also receives excess low-pressure superheated steam from the HRSGs and exhausts to the surface condenser. The steam turbine set is designed to produce additional electrical output, but is not a source of air emissions.

2.2.4 Other Potential Sources

Other facility components associated with the proposed Project include:

- *One 75 MMBtu/hr natural gas fired auxiliary boiler* - operates up to 8,760 hours per year;
- *One 20 MMBtu/hr natural gas fired fuel gas heater* -operates up to 8,760 hours per year;
- *One 2088 bhp emergency diesel generator operating on ultra low sulfur diesel fuel* - operates no more than 500 hours per year;
- *One 330 bhp emergency fire-water pump operating on ultra low sulfur diesel fuel* - operates no more than 500 hours per year; and
- *One 10-cell cooling tower* - operates up to 8,760 hours per year.

Figure 2-1 Location of Proposed Stonewall Energy Project



2.3 Pollutant Emissions

The following discussion of emissions represents preliminary estimates and could vary slightly with what is presented in the PSD Permit Application.

2.3.1 Criteria Pollutant Emissions

Combined-cycle turbines with HRSG are considered fossil fuel-fired steam electric plants (one of the "major stationary source" categories identified in 9 VAC 5-80-1615), and are therefore subject to the PSD permitting requirements if the facility's Potential to Emit (PTE) exceeds 100 tons or more per year of any regulated pollutant. The Stonewall Energy Project will have the potential to emit more than 100 tons per year of one or more regulated NSR pollutant, therefore, this Project is a major stationary source subject to a permit under the provisions of 9 VAC 5 Chapter 80, Article 8 (PSD).

Table 2-1 lists the PSD Significant Emission Rates (SERs). The expected annual emissions from the proposed Project were compared to the PSD SERs to determine the PSD applicability. The expected annual emissions for each of the proposed turbine configurations are discussed in **sub-Section 2.3.1.1.**

The project is also located in a non-attainment area for $PM_{2.5}$ and Ozone and therefore potentially subject to non-attainment new source review for $PM_{2.5}$ and Ozone.

Table 2-1 PSD Significant Emission Rates

Pollutant	Emission Rate (Tons Per Year)
Carbon monoxide	100
Nitrogen oxides	40
Sulfur Dioxides	40
Particulate Matter (PM)	25
Fine Particulate matter (PM_{10})	15
Particulate Matter less than 2.5 microns ($PM_{2.5}$)	10
Ozone	40 of volatile organic compounds
Lead	0.6
Fluorides	3
Sulfuric acid mist	7
Total reduced sulfur	10
Source: 9 VAC 5-80-1615	

Pollutant emissions to the atmosphere from the proposed plant will occur primarily from combustion of fuel in the combustion turbines and to a much lesser extent, from operation of the auxiliary boiler, emergency diesel generator, fire-water pump, and fuel gas heater.

2.3.1.1 Combustion Turbines – Short Term Emissions – Normal Operations

Tables 2-2 and **2-3** list the expected maximum hourly emission rates of criteria pollutants from the proposed GE 7FA.05 and SGT6-5000F5 combined-cycle combustion turbines when firing natural gas, respectively. The combustion turbine data shown in **Tables 2-2** and **2-3** reflects the maximum hourly emissions for the proposed Project over a range of operating loads and ambient operating conditions as summarized below:

GE 7FA.05 – Combined-Cycle Combustion Turbines – Natural Gas Operations

- 6 operating loads (100% [100%, 50% and 10% Duct Firing], 100%, 75%, 50%)
- 3 ambient temperatures (92°F, 59°F, 18°F)

Table 2-2 Preliminary Maximum Hourly Emission Rates of Criteria Pollutants from GE 7FA.05 Combined-Cycle Combustion Turbines – Natural Gas

Pollutant	Combustion Turbine Maximum Hourly Emission Rates (lb/hr) (1) (2)
NO_X	21.0
CO	12.7
PM_{10}	16.2
$PM_{2.5}$	16.2
SO_2	0.75
Pb	0.00141

(1) Hourly emission rates/calculations provided by Green Energy Partners/Stonewall LLC and/or based on vendor information. Emission rates presented in this table are preliminary and are subject to change.

(2) Pollutant emission rates shown represent maximum operation of a single combined-cycle combustion turbine over the proposed 50% to 100% load (plus DB) operating range and for all ambient temperatures.

SGT6-5000F5 – Combined-Cycle Combustion Turbines – Natural Gas Operations

- 4 operating loads (100% w/Duct Firing, 100%, 75%, 50%)
- 3 ambient temperatures (92°F, 59°F, 18°F)

Table 2-3 Preliminary Maximum Hourly Emission Rates of Criteria Pollutants from SGT6-5000F5 Combined-Cycle Combustion Turbines – Natural Gas

Pollutant	Combustion Turbine Maximum Hourly Emission Rates (lb/hr) (1) (2)
NO_X	20.4
CO	12.5
PM_{10}	14.5
$PM_{2.5}$	14.5
SO_2	0.70
Pb	0.00132

(1) Hourly emission rates/calculations provided by Green Energy Partners/Stonewall LLC and/or based on vendor information. Emission rates presented in this table are preliminary and are subject to change.

(2) Pollutant emission rates shown represent maximum operation of a single combined-cycle combustion turbine over the proposed 50% to 100% load (plus DB) operating range and for all ambient temperatures.

2.3.1.2 Auxiliary Equipment – Short Term Emissions – Normal Operations

Table 2-4 lists the maximum hourly emission rates of criteria pollutants from the auxiliary boiler, emergency generator, fire-water pump, fuel gas heater, and cooling tower. Since the diesel fired fire-water pump and diesel emergency generator will be operated no more than 1 hour per week per unit and 52 hours per year per unit for non-emergency use and no more than 500 hours per year per unit of total usage (non-emergency use plus emergency use), the modeled emission rates will be normalized based on the 500 hours per year for annual modeling and 1 hour of operation in the modeled averaging period for short-term modeling.

Table 2-4 Preliminary Maximum Hourly Emission Rates of Criteria Pollutants from the Auxiliary Equipment

Pollutant	Maximum Hourly Emission Rates (lb/hr)(1)				
	NO_X	CO	PM_{10}	$PM_{2.5}$	SO_2
Auxiliary Boiler	0.83	2.78	0.15	0.15	0.02
Diesel-Fired Emergency Generator	21.98	12.02	1.37	1.37	0.0025
Diesel Fire Pump	2.17	1.90	0.22	0.22	0.00039
Fuel Gas Heater	0.22	0.74	0.04	0.04	0.005
Cooling Tower (total for 10 cells)			1.69	0.52	

(1) Hourly emission rate/calculation provided by Green Energy Partners/Stonewall LLC and/or based on vendor information.

2.3.2 Annual Emissions

Potential annual emissions of criteria pollutants from the Stonewall Energy Project are presented in **Tables 2-5** and **2-6**, respectively for the GE 7FA.05 and SGT6-5000F5 turbine options. The potential annual emissions are based on the following:

- The annual emission rate for the combined-cycle turbines is based on the worst-case annual emissions between either 8,760 hours per year of continuous operation or a mix of continuous operation and the maximum number of startup/shutdown events. With the exception of CO (and VOC for SGT6-5000F5 turbines), the worst-case annual emissions were based on 8,760 hours per year of continuous operation consisting of 1,400 hours per year firing natural gas with duct burner and 7,360 hours per year firing natural gas and no duct burner (per turbine);
- The auxiliary boiler will operate up to 8,760 hours per year;
- The diesel fired fire-water pump and diesel emergency generator will be operated no more than 1 hour per week per unit and 52 hours per year per unit for non-emergency use and no more than 500 hours per year per unit of total usage (non-emergency use plus emergency use). Therefore, for modeling associated with these units, the modeled emission rates will be normalized based on the 500 hours per year for annual modeling and 1 hour of operation in the modeled averaging period for short-term modeling; and

- The fuel gas heater will operate up to 8,760 hours per year.
- The cooling tower will operate up to 8,760 hours per year.

Table 2-5 Potential Annual Emission Rate of Criteria Pollutants for Proposed Project – GE 7FA.05

Pollutant	Annual Emission Rate (1) (Tons Per Year)
NO_x	159.2
CO	207.5
PM_{10}	102.3
$PM_{2.5}$	97.2
SO_2	5.44
VOC	37.8
Pb	0.01
H_2SO_4 Mist	2.9

(1) Annual emissions based on the worst-case emissions across all normal operations or normal operations plus startup/shutdown.

Table 2-6 Potential Annual Emission Rate of Criteria Pollutants for Proposed Project – SGT6-5000F5

Pollutant	Annual Emission Rate (1) (Tons Per Year)
NO_x	165.1
CO	389.1
PM_{10}	103.3
$PM_{2.5}$	98.2
SO_2	5.37
VOC	62.6
Pb	0.01
H_2SO_4 Mist	2.8

(1) Annual emissions based on the worst-case emissions across all normal operations or normal operations plus startup/shutdown.

Tables 2-5 and **2-6** above indicate that the proposed Project is a major source under the Federal New Source Review program since potential emissions from the primary sources will be greater than the 100 ton per year PSD major source threshold for CO and NO_X. Emissions for pollutants not exceeding the 100 ton per year threshold were compared to the PSD SERs to determine if additional

pollutants are subject to PSD review. Based on this review, the proposed Project is also subject to PSD review for PM_{10}. The proposed project will not be subject to PSD review for SO_2 and H_2SO_4 because the potential emissions are less than the 40 and 7 TPY significance thresholds, respectively. Thus no modeling for SO_2 will be conducted.

The proposed project is also located in a non-attainment area for ozone and $PM_{2.5}$ and therefore subject to non-attainment new source review for ozone and $PM_{2.5}$. The project will obtain the necessary NO_X offset emissions to satisfy the permitting requirement based on being located in the non-attainment area for ozone.

Additionally, the $PM_{2.5}$ emissions are less than 100 TPY, therefore according to guidance from VA DEQ, non-attainment new source review will not apply for $PM_{2.5}$. Furthermore, the area the proposed Project is to be located in has been petitioned to United States Environmental Protection Agency (US EPA) by VA DEQ to be reclassified as “attainment”. As such, the air dispersion modeling will be conducted under the premise that $PM_{2.5}$ will be subject to PSD review and $PM_{2.5}$ will be modeled in a manner consistent with other pollutants subject to PSD review for the proposed Project.

2.3.3 Startup/Shutdown Operations

Emissions associated with startup/shutdown will be evaluated based on the turbine vendor data. This data in conjunction with guidance from US EPA and VA DEQ will be used to determine if additional modeling is required to be addressed for short-term and annual averaging periods under startup/shutdown operating scenarios.

Preliminary estimates from the turbine vendor suggest that the total hours of startup/shutdown durations will be much less than 500 hours per year. As such, in line with the US EPA guidance found in the March 1, 2011 clarification memorandum “Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS” (EPA 2011), this level of activity could be argued as being intermittent. Therefore, the likelihood is very low that these activities will contribute significantly to the annual distribution of the peak daily 1-hour concentrations for determining compliance with the probabilistic 1-hour NO_2 National Ambient Air Quality Standards (NAAQS). As such, additional modeling will not be performed for startup/shutdown when assessing compliance with the 1-hour SO_2 and 1-hour NO_2 NAAQS.

Other pollutants and averaging periods will be evaluated on a case by case basis to determine the need for additional modeling or if the maximum modeled impacts have been demonstrated by modeling the range of normal operating loads.

2.3.4 Toxic Air Pollutant Emissions

In addition to predicting the ambient air concentrations of criteria pollutants, the concentrations of other pollutants from the proposed Project’s emission sources regulated under VA DEQ air toxics program will be evaluated.

The emissions will be estimated using emission factors (AP-42), vendor data or other reference documents. The potential emissions will be compared to each pollutant’s exemption level. A modeling analysis will be performed for the pollutants which are above the exemption level and the sources that are subject to the regulation. The modeled concentrations will be compared to the corresponding pollutant Significant Ambient Air Concentration (SAAC).

3.0 Air Quality Impact Assessment Methodology

The dispersion modeling analyses conducted for this Project will adhere to the (US EPA "Guideline on Air Quality Models" (GAQM, which is contained in 40 CFR Part 51, Appendix W) and direction received from the VA DEQ Modeling Section. The following sections present the source data to be modeled, the proposed procedure for assessing ambient air impacts from the proposed Project's air emissions and the standards to which the modeled impacts will be compared.

3.1 Background Discussion

The proposed Project will be a major source for VOCs, CO, NO_2, and PM_{10} as discussed in **Section 2.3** of the document; therefore, PSD review and associated dispersion modeling analysis will be required for these pollutants. In addition, modeling will also be conducted for $PM_{2.5}$. Modeling analyses to be performed will evaluate compliance with applicable PSD increments for these pollutants. In addition, compliance with the NAAQS will also be evaluated.

Based on the current Project design, the combustion turbines are the primary sources of pollutant emissions at this plant. Much smaller quantities of criteria pollutants are emitted from the auxiliary boiler, diesel-fired emergency generator, diesel-fired fire water pump, fuel gas heater, and cooling tower.

As will be discussed in the following sections of this protocol, the dispersion modeling for this Project will be conducted in a manner that utilizes the worst-case operating conditions for the combustion turbines associated with the ambient temperature range in an effort to predict the highest impact for each averaging period. Maximum predicted impacts from the worst case scenarios will be compared to the Significant Impact Levels (SILs). For those pollutants which have Project modeled impacts below the applicable SIL, no additional analysis will be necessary since, by definition, the Project cannot cause or contribute to a NAAQS violation or and exceedance of a PSD increment. If modeling of the Project emissions indicates that SILs for some pollutants and averaging periods are exceeded, then a cumulative impact assessment will be undertaken based on the corresponding worst-case operating conditions. The results of the cumulative modeling will be analyzed for comparison to the NAAQS and PSD increments, if applicable.

3.2 Source Data

The air dispersion modeling analysis will be conducted with emission rates and flue gas exhaust characteristics (flow rate and temperature) that are expected to represent the worst-case parameters among the range of possible values considered for the proposed Project.

The stack parameters and the criteria pollutant emissions for the turbine configuration are presented in the following sub-sections.

3.2.1 Combined-Cycle Combustion Turbines

Based on current Project design parameters, Green Energy Partners/Stonewall LLC intends to apply for a permit that will allow unrestricted annual operation (8,760 hours per year) of each combined-cycle combustion turbine. The 8,760 hours of operation will be composed of 1,400 hours of natural gas firing with duct burner and 7,360 hours of natural gas firing without duct burner.

Since turbine emission rates and flue gas characteristics for a given turbine load vary as a function of ambient temperature, data was derived for the following ambient temperatures and load scenarios for both of the proposed turbine options.

GE 7FA.05 – Combined-Cycle Combustion Turbines – Natural Gas Operations

- 6 operating loads (100% [100%, 50% and 10% Duct Firing], 100%, 75%, 50%)
- 3 ambient temperatures (92°F, 59°F, 18°F)

A summary of the GE 7FA.05 combined-cycle exhaust data and emission rates for the PSD-regulated pollutants for each ambient temperature and operating load during natural gas combustion is provided in **Table 3-1**.

SGT6-5000F5 – Combined-Cycle Combustion Turbines – Natural Gas Operations

- 4 operating loads (100% w/Duct Firing, 100%, 75%, 50%)
- 3 ambient temperatures (92°F, 59°F, 18°F)

A summary of the SGT6-5000F5 combined-cycle exhaust data and emission rates for the PSD-regulated pollutants for each ambient temperature and operating load during natural gas combustion is provided in **Table 3-2**.

In order to conservatively calculate ground-level concentrations, a composite "worst-case" set of emission parameters will be used in the modeling in an initial approach. For each combined-cycle operating load in the initial modeling, the highest pollutant-specific emission rate coupled with the lowest exhaust temperature and exhaust flow rate will be selected. **Tables 3-3** and **3-4** summarize the worst-case emission parameters for the GE 7FA.05 and SGT6-5000F5 combined-cycle operating loads firing natural gas, respectively. If necessary, the analysis will be refined by expanding the modeling to cover specific operating cases rather than using the worst-case envelope approach.

Startup/shutdown modeling will be addressed using the methods/emissions presented in **Section 2.3.3.**

Table 3-1 Source Parameters and Criteria Pollutant Emission Rates[1] Natural Gas-Fired GE 7FA.05 Combined-Cycle Combustion Turbine Operation

Scenario[2]	Stack Height (ft)	Stack Dia. (ft)	Exit Temp. (°F)	Exit Velocity (fps)	Maximum Hourly Emissions (lb/hr)[3]			
					NO_X	CO	PM_{10}	$PM_{2.5}$
100% Load – 18°F amb. 100% DB, no Evap Cooling	140	18.5	164	72.78	21.0	12.7	16.2	16.2
100% Load – 18°F amb. 50% DB, no Evap Cooling	140	18.5	172	74.03	18.5	11.3	13.4	13.4
100% Load – 18°F amb. 10% DB, no Evap Cooling	140	18.5	180	75.34	16.7	10.2	15.0	15.0
100% Load – 18°F amb. no DB, no Evap Cooling	140	18.5	183	75.64	16.2	9.9	9.6	9.6
75% Load – 18°F amb. no DB, no Evap Cooling	140	18.5	171	60.01	12.8	7.8	9.6	9.6
50% Load – 18°F amb. no DB, no Evap Cooling	140	18.5	152	44.82	9.8	6.0	9.5	9.5
100% Load – 59°F amb. 100% DB, with Evap Cooling	140	18.5	164	68.43	20.0	12.1	16.2	16.2
100% Load – 59°F amb. 50% DB, with Evap Cooling	140	18.5	173	69.80	17.6	10.8	13.4	13.4
100% Load – 59°F amb. 10% DB, with Evap Cooling	140	18.5	182	71.09	15.7	9.6	15.0	15.0
100% Load – 59°F amb. no DB, with Evap Cooling	140	18.5	185	71.39	15.3	9.3	9.6	9.6
100% Load – 59°F amb. no DB, no Evap Cooling	140	18.5	184	70.52	15.0	9.1	9.6	9.6
75% Load – 59°F amb. no DB, no Evap Cooling	140	18.5	169	54.82	12.0	7.3	9.6	9.6
50% Load – 59°F amb. no DB, no Evap Cooling	140	18.5	156	43.88	9.3	5.6	9.5	9.5

Scenario[2]	Stack Height (ft)	Stack Dia. (ft)	Exit Temp. (°F)	Exit Velocity (fps)	Maximum Hourly Emissions (lb/hr)[3]			
					NO_X	CO	PM_{10}	$PM_{2.5}$
100% Load – 92°F amb. 100% DB, with Evap Cooling	140	18.5	170	68.09	19.5	11.8	16.2	16.2
100% Load – 92°F amb. 50% DB, with Evap Cooling	140	18.5	178	69.38	17.1	10.5	13.4	13.4
100% Load – 92°F amb. 10% DB, with Evap Cooling	140	18.5	187	70.71	15.2	9.3	15.0	15.0
100% Load – 92°F amb. no DB, with Evap Cooling	140	18.5	190	71.00	14.8	9.0	9.6	9.6
100% Load – 92°F amb. no DB, no Evap Cooling	140	18.5	188	68.45	14.1	8.6	9.6	9.6
75% Load – 92°F amb. no DB, no Evap Cooling	140	18.5	169	51.59	11.3	6.9	9.5	9.5
50% Load – 92°F amb. no DB, no Evap Cooling	140	18.5	163	44.56	9.0	5.5	9.5	9.5
100% Load – 92°F amb. 100% DB, no Evap Cooling	140	18.5	167	65.60	18.9	11.4	16.2	16.2
100% Load – 92°F amb. 50% DB, no Evap Cooling	140	18.5	175	66.84	16.4	10.0	13.4	13.4

(1) Data provided by Green Energy Partners/Stonewall LLC. Source parameters and emission rates presented in this table are preliminary and are subject to change.

(2) Data presented are for multiple operating loads/conditions at three ambient temperatures.

(3) Hourly emissions reflect operation of a single GE 7FA5.05 combined-cycle combustion turbine firing pipeline natural gas only.

Table 3-2 Source Parameters and Criteria Pollutant Emission Rates[1] Natural Gas-Fired SGT6-5000F5 Combined-Cycle Combustion Turbine Operation

Scenario[2]	Stack Height (ft)	Stack Dia. (ft)	Exit Temp. (°F)	Exit Velocity (fps)	Maximum Hourly Emissions (lb/hr)[3]			
					NO_X	CO	PM_{10}	$PM_{2.5}$
100% Load – 18°F amb. no DB, no Evap Cooling	140.0	18.5	197	76.15	16.9	10.3	9.7	9.7
100% Load – 18°F amb. with 100% DB, no Evap Cooling	140.0	18.5	177	74.01	20.3	12.4	14.3	14.3
75% Load – 18°F amb. no DB, no Evap Cooling	140.0	18.5	188	63.25	13.6	8.3	8.2	8.2
50% Load – 18°F amb. no DB, no Evap Cooling	140.0	18.5	186	52.14	10.4	6.4	8.0	8.0
100% Load – 59°F amb. no DB, no Evap Cooling	140.0	18.5	201	80.51	17.1	10.4	10.1	10.1
100% Load – 59°F amb. with 100% DB, with Evap Cooling	140.0	18.5	185	77.65	20.4	12.5	14.5	14.5
75% Load – 59°F amb. no DB, no Evap Cooling	140.0	18.5	186	63.24	13.7	8.3	8.2	8.2
50% Load – 59°F amb. no DB, no Evap Cooling	140.0	18.5	183	51.66	10.4	6.4	8.0	8.0
100% Load – 92°F amb. no DB, no Evap Cooling	140.0	18.5	203	76.51	16.0	9.7	9.4	9.4
100% Load – 92°F amb. with 100% DB, with Evap Cooling	140.0	18.5	185	76.96	20.0	12.2	14.3	14.3
75% Load – 92°F amb. no DB, no Evap Cooling	140.0	18.5	190	59.98	12.8	7.8	8.0	8.0
50% Load – 92°F amb. no DB, no Evap Cooling	140.0	18.5	187	49.16	9.8	6.0	8.0	8.0

(1) Data provided by Green Energy Partners/Stonewall LLC. Source parameters and emission rates presented in this table are preliminary and are subject to change.

(2) Data presented are for multiple operating loads/conditions at three ambient temperatures.

(3) Hourly emissions reflect operation of a single SGT6-5000F5 combined-cycle combustion turbine firing pipeline natural gas only.

Table 3-3 Worst Case Data (1) for Proposed Natural Gas-Fired GE 7FA.05 Combined-Cycle Combustion Turbine Operation

Parameter		Value					
Load (%)		**100% Load 100% DB**	**100% Load 50% DB**	**100% Load 10% DB**	**100% Load**	**75% Load**	**50% Load**
Stack Height (ft)		140.0	140.0	140.0	140.0	140.0	140.0
Stack Diameter (ft)		18.5	18.5	18.5	18.5	18.5	18.5
Exit Temperature (°F)		164	172	180	183	169	152
Exit Velocity (ft/sec)		65.60	66.84	70.71	68.45	51.59	43.88
Emission Rate per Turbine (lbs/hr)	**PM_{10}**	16.2	13.4	15.0	9.6	9.6	9.5
	$PM_{2.5}$	16.2	13.4	15.0	9.6	9.6	9.5
	NO_X	21.0	18.5	16.7	16.2	12.8	9.8
	CO	12.7	11.3	10.2	9.9	7.8	6.0

(1) The values in the table represent the worst-case stack parameters and the emission rates for the four operating loads taken from the Table 3-1.

Table 3-4 Worst Case Data (1) for Proposed Natural Gas-Fired SGT6-5000F5 Combined-Cycle Combustion Turbine Operation

Parameter		Value			
Load (%)		**100% Load 100% DB**	**100% Load**	**75% Load**	**50% Load**
Stack Height (ft)		140.0	140.0	140.0	140.0
Stack Diameter (ft)		18.5	18.5	18.5	18.5
Exit Temperature (°F)		177	197	186	183
Exit Velocity (ft/sec)		74.01	76.15	59.98	49.16
Emission Rate per Turbine (lbs/hr)	**PM_{10}**	14.5	10.1	8.2	8.0
	$PM_{2.5}$	14.5	10.1	8.2	8.0
	NO_X	20.4	17.1	13.7	10.4
	CO	12.5	10.4	8.3	6.4

(1) The values in the table represent the worst-case stack parameters and the emission rates for the four operating loads taken from the Table 3-2.

3.2.2 Ancillary Support Equipment

Table 3-5 provides preliminary stack parameters and criteria pollutant emission rates for the auxiliary boiler, fuel gas heater and cooling tower.

Since the performance data for the auxiliary equipment are not affected by ambient conditions, only one set of parameters will be modeled (e.g., stack parameters and emission rates associated with 100% load). The auxiliary boiler, fuel gas heater and cooling tower are expected to operate 8,760 hours per year. Thus, the emission rates in **Table 3-5** are appropriate for both short-term and annual modeling.

The emergency diesel generator and fire-water pump engine are expected to operate 1 hour per week per unit and 52 hours per year per unit under non-emergency conditions (operability testing) and no more than 500 total hours per year. Therefore, the modeled short-term emissions (24-hour or less) will be normalized to reflect operation of 1 hour within the averaging period for the assessment of short-term modeled averaging periods. The modeled annual emission rates will be normalized based on the 500 hours per year for the assessment of annual modeled averaging periods. Additionally, for 1-hour NO_2, these emergency units will not be included in the modeling due to their intermittent operations (e.g. less than 500 hours per year) based on US EPA guidance for modeling intermittent sources (EPA 2011). **Table 3-6** provides preliminary stack parameters and criteria pollutant emission rates for the emergency generator and the fire water pump. Please note that the Project will accept a permit condition for each unit that limits non-emergency use to 500 hours per year.

Table 3-5 Source Parameters and Criteria Pollutant Emission Rates[(1)] for the Auxiliary Equipment

Source ID	Stack Height (ft)	Stack Diameter (ft)	Exit Temp. (°F)	Exit Velocity (fps)	Hourly Emissions (lb/hr)			
					NO_X	CO	PM_{10}	$PM_{2.5}$
Auxiliary Boiler								
AUXB	40.0	3.0	260	46.52	0.83	2.78	0.15	0.15
Fuel Gas Heater								
FGH	15.0	1.52	300	50.0	0.22	0.74	0.04	0.04
Cooling Tower[(2)]								
CT1-CT10	70.0	33.0	83	25.3			0.169	0.052

(1) Data provided by Green Energy Partners/Stonewall LLC. Source parameters and emission rates presented in this table are preliminary and are subject to change. Should emissions or stack parameters change, the modeling will be re-evaluated if necessary.

(2) Data is provided for 1 of the 10 cooling tower cells.

Table 3-6 Source Parameters and Criteria Pollutant Emission Rates[(1)] For the Emergency Equipment

Source ID	Stack Height (ft)	Stack Diameter (ft)	Exit Temp. (°F)	Exit Velocity (fps)	Hourly Emissions (lb/hr)						
					NO_X	CO		PM_{10}		$PM_{2.5}$	
					Ann	1-hr	8-hr	24-hr	Ann	24-hr	Ann
Diesel-Fired Emergency Generator											
EDG	20.0	1.21	987	133.3	1.25	12.02	1.50	0.057	0.078	0.057	0.078
Diesel-Fired Fire Water Pump Engine											
EFP	20.0	0.49	800	133.3	0.12	1.90	0.24	0.009	0.013	0.009	0.013

(1) Data provided by Green Energy Partners/Stonewall LLC. Source parameters and emission rates presented in this table are preliminary and are subject to change. Should emissions or stack parameters change, the modeling will be re-evaluated if necessary.

3.3 Model Selection

The suitability of an air quality dispersion model for a particular application is dependent upon several factors. The following selection criteria were evaluated:

- stack height relative to nearby structures;
- dispersion environment;
- local terrain; and
- representative meteorological data.

The US EPA GAQM and the AQMD Modeling Guidance for AERMOD (EPA 2004a) prescribe a set of approved models for regulatory applications for a wide range of source types and dispersion environments. Based on a review of the factors discussed below, the latest version of AERMOD (12060) is proposed to assess air quality impacts for the Project.

3.4 Meteorological Data for AERMOD

Five years (2007-2011) of hourly surface meteorological data from Dulles International Airport, VA along with concurrent upper air data from Sterling, VA will be processed with AERMET (EPA 2004b), the meteorological preprocessor for AERMOD. **Table 3-7** gives site locations and information on these data sets. The surface data (wind direction, wind speed, temperature, sky cover, and relative humidity) at Dulles is measured 10.0 m above ground level.

AECOM will utilize the latest version of AERMET (11059) and AERMINUTE (11325), the meteorological preprocessors, to create AERMOD-Ready meteorological inputs.

AERMET creates two output files for input to AERMOD:

- SURFACE: a file with boundary layer parameters such as sensible heat flux, surface friction velocity, convective velocity scale, vertical potential temperature gradient in the 500-meter layer above the planetary boundary layer, and convective and mechanical mixing heights. Also provided are values of Monin-Obukhov length, surface roughness,

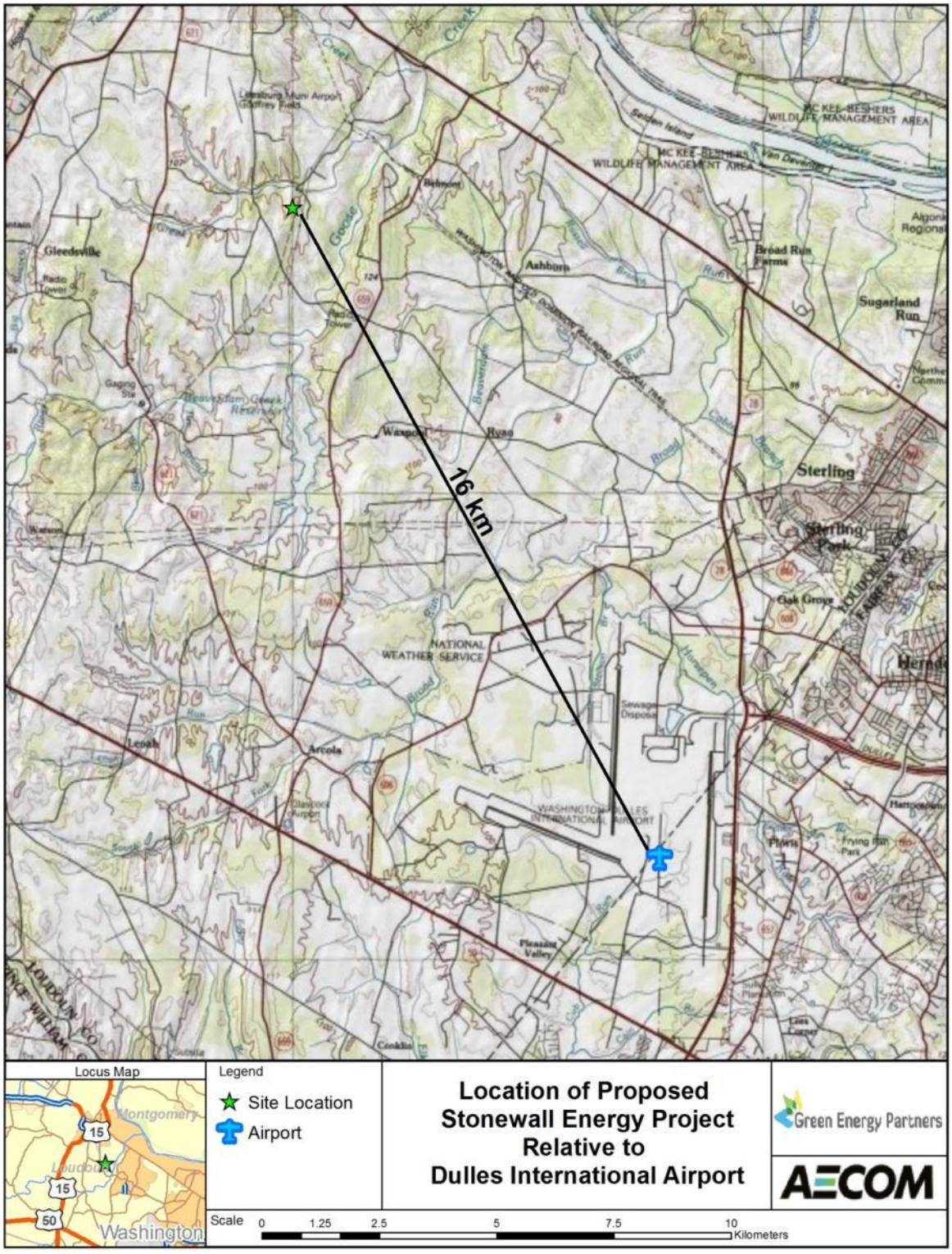
albedo, Bowen ratio, wind speed, wind direction, temperature, and heights at which measurements were taken.

- PROFILE: a file containing multi-level meteorological data with wind speed, wind direction, temperature, sigma-theta (σ_θ) and sigma-w (σ_w) when such data are available. For this application involving representative data from the nearest NWS station, the profile file will contain a single level of wind data (6.1 meters) and the temperature data (2 meters).

Table 3-7 Meteorological Data Used in Running AERMET

Met Site	Latitude	Longitude	Base Elevation (m)	Data Source	Data Format
Dulles Airport, VA	38.934	-77.447	88	NCDC	ISHD and 1-min ASOS
Sterling, VA	38.983	-77.467	85	FSL	FSL

Figure 3-1 Location of Project Site Relative to Dulles International Airport



In running AERMET, the observed airport hourly wind direction will be randomized. Missing morning soundings in the Sterling, VA upper air files will be filled with soundings from Aberdeen, Maryland if available, or the previous day's sounding from Sterling if Aberdeen soundings are also missing.

AERMET requires specification of site characteristics including surface roughness (z_o), albedo (r), and Bowen ratio (B_o). These parameters will be developed according to the guidance provided by US EPA in the recently revised AERMOD Implementation Guide (AIG) (EPA, 2009) and input provided by VA DEQ.

The revised AIG provides the following recommendations for determining the site characteristics:

1. The determination of the surface roughness length should be based on an inverse distance weighted geometric mean for a default upwind distance of 1 kilometer relative to the measurement site. Surface roughness length may be varied by sector to account for variations in land cover near the measurement site; however, the sector widths should be no smaller than 30 degrees.
2. The determination of the Bowen ratio should be based on a simple un-weighted geometric mean (i.e., no direction or distance dependency) for a representative domain, with a default domain defined by a 10-km by 10-km region centered on the measurement site.
3. The determination of the albedo should be based on a simple un-weighted arithmetic mean (i.e., no direction or distance dependency) for the same representative domain as defined for Bowen ratio, with a default domain defined by a 10-km by 10-km region centered on the measurement site.

The AIG recommends that the surface characteristics be determined based on digitized land cover data. US EPA has developed a tool called AERSURFACE (EPA 2008) that can be used to determine the site characteristics based on digitized land cover data in accordance with the recommendations from the AIG discussed above. AERSURFACE incorporates look-up tables of representative surface characteristic values by land cover category and seasonal category. AERSURFACE will be applied with the instructions provided in the AERSURFACE User's Guide and input provided by VA DEQ.

The current version of AERSURFACE (Version 08009) supports the use of land cover data from the USGS National Land Cover Data 1992 archives[1] (NLCD92). The NLCD92 archive provides data at a spatial resolution of 30 meters based upon a 21-category classification scheme applied over the continental U.S. The AIG recommends that the surface characteristics be determined based on the land use surrounding the site where the surface meteorological data were collected. The selection of the land use types assigned in the NLCD92 database was reviewed and altered with justification provided in **Appendix D** based upon an analysis of the NLCD92 database.

As recommended in the AIG for surface roughness, the 1-km radius circular area centered at the meteorological station site can be divided into sectors for the analysis; each chosen sector has a mix of land uses that is different from that of other selected sectors. Sectors used to define the meteorological surface characteristics for the airport site are shown in **Figure 3-2**.

[1] http://edcftp.cr.usgs.gov/pub/data/landcover/states/

In AERSURFACE, the various land cover categories are linked to a set of seasonal surface characteristics. As such, AERSURFACE requires specification of the seasonal category for each month of the year. The following five seasonal categories are supported by AERSURFACE, with the applicable months of the year specified for this site as provided by VA DEQ.

- Midsummer with lush vegetation (May-September);
- Autumn with un-harvested cropland (October-November);
- Late autumn after frost and harvest, or winter with no snow (December-February);
- Winter with continuous snow on ground (none); and
- Transitional spring with partial green coverage or short annuals (March-April).

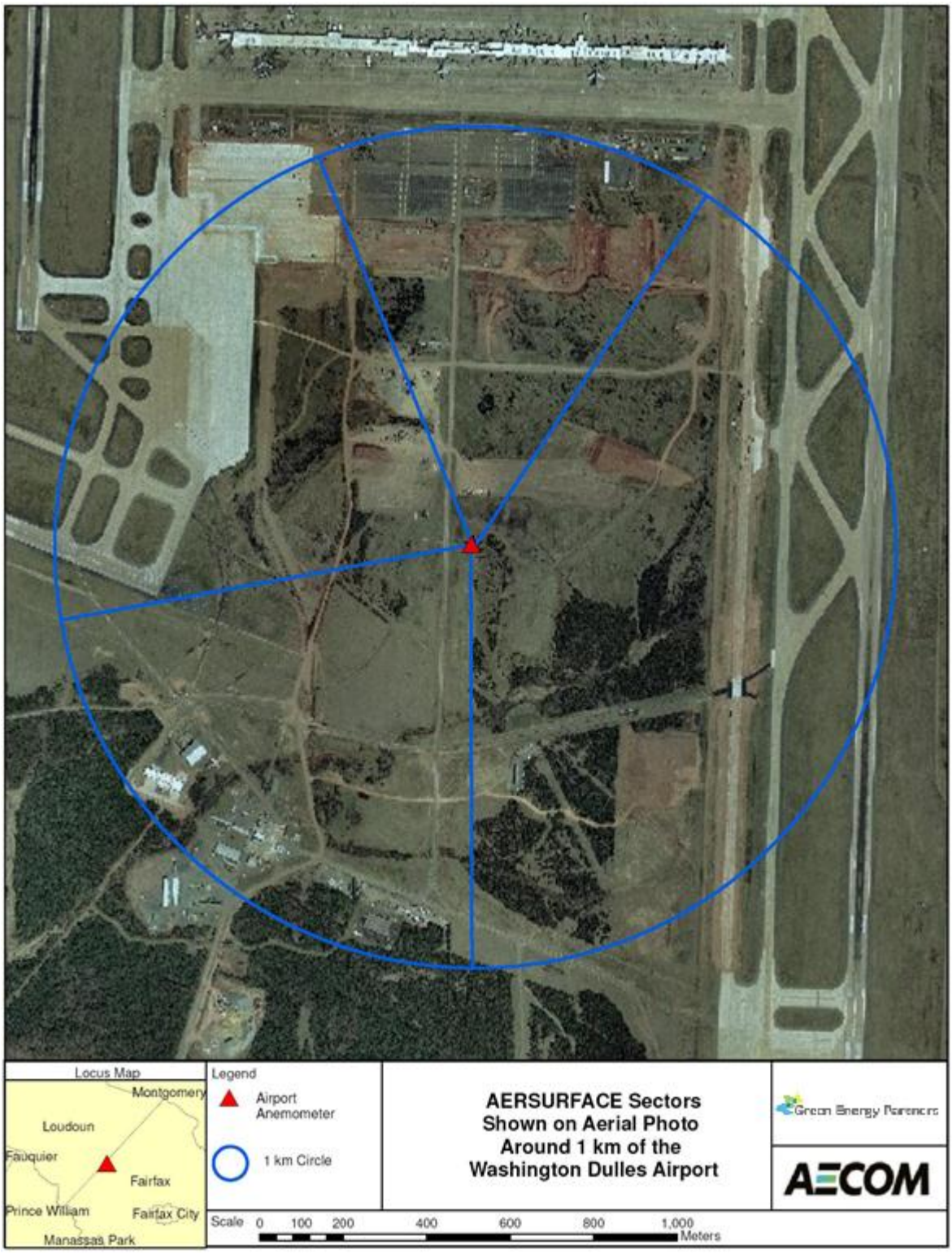
For Bowen ratio, the land use values are linked to three categories of surface moisture corresponding to average, wet and dry conditions. The surface moisture condition for the site may vary depending on the meteorological data period for which the surface characteristics will be applied. AERSURFACE applies the surface moisture condition for the entire data period. Therefore, if the surface moisture condition varies significantly across the data period, then AERSURFACE can be applied multiple times to account for those variations. As recommended in AERSURFACE User's Guide, the surface moisture condition for each month will be determined by comparing precipitation for the period of data to be processed to the 30-year climatological record, selecting "wet" conditions if precipitation is in the upper 30th-percentile, "dry" conditions if precipitation is in the lower 30th-percentile, and "average" conditions if precipitation is in the middle 40th-percentile. The 30-year precipitation data set used in this modeling will be taken from Dulles International Airport, Virginia. **Appendix B** contains the 30-years of monthly precipitation data obtained from NCDC. The 30-year period of record used to establish the 30-year average monthly precipitation totals include 1981 through 2010.

The monthly designations of surface moisture input to AERSURFACE are summarized in **Table 3-8**.

Table 3-8 AERSURFACE Bowen Ratio Condition Designations

Month	2007	2008	2009	2010	2011
January	average	dry	average	dry	dry
February	average	average	dry	wet	average
March	average	average	dry	average	wet
April	average	wet	average	dry	wet
May	dry	wet	wet	wet	average
June	average	average	wet	dry	dry
July	dry	dry	dry	average	average
August	dry	average	average	average	average
September	dry	wet	dry	wet	wet
October	average	dry	wet	average	wet
November	dry	dry	average	average	dry
December	average	average	wet	dry	wet

Figure 3-2 Sectors Used for Surface Characteristics at Dulles International Airport



3.5 Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis will be performed based on the proposed plant design to determine the potential for building-induced aerodynamic downwash for all modeled stacks. The analysis procedures described in US EPA's Guidelines for Determination of Good Engineering Practice Stack Height (EPA 1985), Stack Height Regulations (40 CRF 51), and current Model Clearing house guidance will be used.

The GEP formula height is based on the observed phenomena of disturbed atmospheric flow in the immediate vicinity of a structure resulting in higher ground level concentrations at a closer proximity to the building than would otherwise occur. It identifies the minimum stack height at which significant aerodynamic downwash is avoided. The GEP formula stack height, as defined in the 1985 final regulations, is calculated from:

$$H_{GEP} = H_{BLDG} + 1.5L$$

Where:

- H_{GEP} is the maximum GEP stack height;
- H_{BLDG} is the height of the nearby structure; and
- L is the lesser dimension (height or projected width) of the nearby structure.

For a squat structure, i.e., height less than projected width, the formula reduces to:

$$H_{GEP} = 2.5H_B$$

Both the height and width of the structure are determined from the frontal area of the structure projected onto a plane perpendicular to the direction of the wind. In all instance, the GEP stack height is based on the plane projections of any nearby building which result in the greatest justifiable height. For purposes of the GEP analysis, nearby refers to the "sphere of influence", defined as five times the height or width of the building, whichever is less, downwind from the trailing edge of the structure. In the case where a stack is not influenced by nearby structures, the maximum GEP stack height is defined as 65 meters.

The current facility design has all modeled stacks less than 65 meters. As such, all stacks will be modeled with their actual stack height. In addition, the US EPA's Building Profile Input Program (BPIP-Version 04274) version that is appropriate for use with PRIME algorithms in AERMOD will be used to incorporate downwash effects in the model for all modeled stacks. The building dimensions of each structure will be input in BPIPPRM program to determine direction specific building data. PRIME addresses the entire structure of the wake, from the cavity immediately downwind of the building, to the far wake.

3.6 Receptor Grid and AERMAP Processing

The Class II grid will consist of receptors spaced 25 meters (m) apart along the fence line. The facility plot plan shows a depiction of the preliminary fence line established for the Project site. A spacing of 50 m will be used for the receptors beyond the fence line and extending out to 1 km from the fence line. Beyond 1 km from the fence line, a spacing of 100 m will be used up to 2.5 km from the plant. Between 2.5 and 5 km, a spacing of 500 m will be used. Between 5 and 10 km, a spacing of 1000 m will be used. Beyond 10 km, a spacing of 2000 m will be used. The receptor grid used in the modeling analysis will be based on UTM coordinates referenced to NAD 83 datum and in zone 18.

The extent of this grid is expected to be sufficient to capture maximum impacts in the Class II area. However, if highest impacts are predicted at the edge of the grid at a distance of 20 km from the Project site, additional receptors may be required to ensure that the distance covered by the Significant Impact Area (SIA) is determined. Furthermore, for those pollutants and averaging periods that are modeled to be insignificant and whose impacts are predicted outside 50-m spaced receptors, a refined receptor grid (50-m spacing) will be used to ensure the maximum impacts are resolved. For those pollutants and averaging periods that are modeled to have significant impacts, 50-m spaced receptors will be used to resolve the highest concentrations as a part of the cumulative NAAQS and PSD increment modeling.

The receptors used for the cumulative modeling will be limited to those receptors within a radius of facility set to be the maximum the SILs are exceeded (known as the Significant Impact Area – SIA) or just for the receptors in which a significant impact is modeled for each pollutant and averaging period.

AERMAP (version 11103) (USEPA 2004c), AERMOD terrain preprocessor program, will be used to calculate terrain elevations and critical hill heights for the modeled receptors (NAD83 datum and zone 18) using National Elevation Data (NED). The dataset that will be downloaded from the USGS website (http://seamless.usgs.gov/) will consist of 1/3 arc second (~10 m resolution) NED. As per the AERMAP User's Guide (USEPA, 2004), the domain will be sufficient to ensure that all significant nodes are included such that all terrain features that exceed a 10% elevation slope from any given receptor are considered.

3.7 Class II Area Modeling Analyses

A refined modeling analysis will be conducted using AERMOD (version 12060) for both turbine options. The analysis will be conducted to demonstrate compliance with the NAAQS and PSD increments. For those pollutants and averaging periods that predict impacts above their applicable SIL, as shown in **Table 3-9**, a refined cumulative modeling analysis which will consider additional NAAQS and PSD increment consuming sources will be conducted to determine compliance with the NAAQS and PSD increments.

3.7.1 Class II Area SIL Analysis

The Class II Area SIL analysis will be conducted for both turbine options using the five years of meteorological data prepared as described in **Section 3.4**. This modeling analysis will be used to make a determination of modeled significance for NO_2, PM_{10}, $PM_{2.5}$, and CO.

For all pollutants except 24-hour and annual $PM_{2.5}$ and 1-hour NO_2, the determination of significance will be made using the highest short-term and highest annual modeled concentration over each of the five years modeled. For 24-hour and annual $PM_{2.5}$, according to the US EPA guidance found in the March 23, 2010 clarification memorandum "Modeling Procedures for Demonstrating Compliance with $PM_{2.5}$ NAAQS" (EPA 2010), the determination of significance will be based on the highest 5-year average 24-hour and annual modeled concentrations respectively. For 1-hour NO_2, according to the US EPA guidance found in the March 1, 2011 clarification memorandum "Additional Clarification Regarding Applicability of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS" (EPA 2011), the determination of significance will be based on the highest 5-year average 1-hour modeled concentrations.

Based on current guidance, NO_2 impacts can be determined by using a 3-tiered NO_x to NO_2 conversion rate system, where:

- Tier 1 assumes 100 percent NO to NO_2 conversion;
- Tier 2 assumes an annual 75 percent NO_2/NO_x ratio and a 1-hour 80 percent NO_2/NO_x ratio (Ambient Ratio Method); and
- Tier 3 allows the use of refined techniques such as the Ozone Limiting Method (OLM) or the Plume Volume Molar Ratio Method (PVMRM). Both OLM and PVMRM are in AERMOD.

For this Project, initial impacts will be assessed using the US EPA Tier 2 methodology for estimating NO_2 concentrations from total NO_X emissions. If it is determined that Tier 3 refined NO_2 modeling with AERMOD is required, the procedures for conducting this modeling will be discussed with VA DEQ at the appropriate time.

For those pollutants and averaging periods with impacts less than their SILs, then no further modeling will be required because, by definition, those pollutants and averaging periods cannot cause or contribute to a violation of the NAAQS or exceedances of the PSD increments. For those pollutants and averaging periods with significant impacts, the SIA will be determined from all possible operating scenarios and turbine options (including startup/shutdown), and then the air quality analysis will then be expanded to include a demonstration of compliance with applicable ambient standards and PSD increments as described in **Section 3.7.2**.

Initially the primary $PM_{2.5}$ emissions will be modeled for this project to determine significance. If the project has insignificant impacts from the primary $PM_{2.5}$ alone, then secondary $PM_{2.5}$ will be included in the SIL analysis to confirm the project's total $PM_{2.5}$ impact (primary plus secondary) is less than the SIL. If the project has significant modeled impacts using the primary $PM_{2.5}$ alone, then no additional SIL modeling will be conducted and secondary $PM_{2.5}$ will be included as part of the cumulative NAAQS and PSD increment modeling demonstrations.

Table 3-9 Criteria Pollutant Class II Significant Impact Levels

Pollutant	Averaging Time (1)				
	Annual $\mu g/m^3$	**24-hour** $\mu g/m^3$	**8-hour** $\mu g/m^3$	**3-hour** $\mu g/m^3$	**1-hour** $\mu g/m^3$
NO_2	1	-	-	-	7.5
CO	-	-	500	-	2000
PM_{10}	1	5	-	-	-
$PM_{2.5}$	0.3	1.2			

(1) High 1st high modeled concentration.

Sources: 9 VAC 5-80-1715 B.1, 40 CFR 50, 64864 Federal Registrar - Vol 75 - No. 202, EPA Clarification Memorandums

3.7.2 Compliance with Class II Area Ambient Air Quality Standards and PSD Increments

As stated previously for those pollutants and averaging periods determined to be less than the SILs, no further analysis will be performed. The discussion below applies only to those pollutants and averaging periods for which a significant impact is predicted with AERMOD.

Compliance with the PSD increments and NAAQS would be based on the sum of the following:

- Modeled impacts attributable to the Project;
- Modeled impacts from “nearby” sources; and
- Representative ambient background concentration (NAAQS only).

Impacts attributable to Project and “nearby” sources will be estimated using AERMOD.

An inventory of sources will be obtained from the appropriate state agencies for each pollutant which exceeds the SIL. Two classes of facilities will be included. For the evaluation of PSD increments, only sources that received PSD permits or have been designated by the appropriate state agency as PSD increment consuming sources will be included. Also, any sources that expand PSD increment could be included in the analysis. For the evaluation of NAAQS, all sources of the applicable pollutant will be evaluated for potential inclusion into the modeled NAAQS inventory. Some facilities with a low ratio of total emissions over distance from the proposed Project may not be included in the NAAQS analysis as the contribution from these sources would likely be minimal and accounted for in the ambient background being added to the modeled concentrations.

For the cumulative impact analysis, the modeled design short-term and annual impacts from the proposed Project, as well as influencing nearby emission sources, will be compared with the NAAQS and PSD increments. Please note, primary plus secondary $PM_{2.5}$ impacts will be accounted for from the project source, secondary $PM_{2.5}$ impacts will not be accounted for from the background sources. The standards are presented in **Table 3-10** and **3-11**. For the NAAQS analysis, a conservative background concentration will be added to modeled design short-term and annual impacts to determine compliance. **Section 4** provides more detail on the use of representative monitored ambient background concentrations

If necessary, the modeled concentrations for the PSD increment and NAAQS compliance modeling will be calculated based on guidance from VA DEQ and the form of the applicable NAAQS or PSD increment as appropriate.

Table 3-10 National Ambient Air Quality Standards

Pollutant	Averaging Period	Class II NAAQS	Units	Form (Design)
CO	1-hour	40,000	$\mu g/m^3$	Not to be exceeded more than once per year.
	8-hour	10,000	$\mu g/m^3$	
NO_2	1-hour	188	$\mu g/m^3$	98th percentile, averaged over 3 years.
	Annual	100	$\mu g/m^3$	Annual Mean.
PM_{10}	24-hour	150	$\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years.
$PM_{2.5}$	24-hour	35	$\mu g/m^3$	98th percentile, averaged over 3 years.
	Annual	15	$\mu g/m^3$	Annual mean, averaged over 3 years.
* Standard recently revoked by USEPA. Source: 9 VAC 5 Chapter 30				

Table 3-11 PSD Increments

Pollutant	Averaging Period	Class II NAAQS	Units	Form (Design)
NO_2	Annual	25	$\mu g/m^3$	Annual Mean.
PM_{10}	24-hour	30	$\mu g/m^3$	Not to be exceeded more than once per year on average over 3 years.
	Annual*	17	$\mu g/m^3$	Annual Mean.
$PM_{2.5}$	24-hour	9	$\mu g/m^3$	98th percentile, averaged over 3 years.
	Annual	4	$\mu g/m^3$	Annual mean, averaged over 3 years.
Source: 9 VAC 5-80-1635, 40 CFR 50, 64864 Federal Registrar - Vol 75 - No. 202				

4.0 Background Air Quality and Pre-Construction Monitoring

4.1 Available Representative Data

Ambient air quality data are used to represent the contribution to total ambient air pollutant concentrations from non-modeled sources. In accordance with 40 CFR 52.21(m), an application for a PSD permit must contain an analysis of ambient air quality in the vicinity of the proposed Project for each pollutant subject to PSD review. The objective of reviewing these data is to develop representative background concentrations which, when added to modeled impacts, are used in the NAAQS compliance analysis. The representative background concentrations contained in **Table 4-1** are being proposed for use in this project. **Table 4-1** summarizes background concentrations that will be used as part of the NAAQS modeling demonstration if necessary.

For NO_2 and $PM_{2.5}$, the background monitors are located in Loudoun Co within 5 kilometers of the proposed Project site and should be very representative of background air quality data for the proposed Project. The CO and PM_{10} monitors are further away, however should conservatively represent background air quality for the proposed project site. The proposed Project site is located in a more rural area within a population density of 606 pop/mi^2 as compared to the location of the PM_{10} and CO monitors which have population densities in Fredericksburg and Arlington Counties of 2,210 pop/mi^2 and 7995 pop/mi^2, respectively.

Table 4-1 Monitored Background Concentrations

Pollutant	Averaging Period	Concentration[(1)]	Units	Location	State
PM_{10}	24-hour	40	$\mu g/m^3$	Fredericksburg	VA
$PM_{2.5}$	24-hour	20	$\mu g/m^3$	Loudoun Co.	VA
	Annual	9.5	$\mu g/m^3$	Loudoun Co.	VA
NO_2	1-hour	41	ppb	Loudoun Co.	VA
	Annual	8	ppb	Loudoun Co.	VA
CO	1-hour	2.2	ppm	Arlington Co.	VA
	8-hour	1.8	ppm	Arlington Co.	VA

4.2 Pre-construction Monitoring

The PSD regulations require that a PSD permit application contain an analysis of existing air quality for all regulated pollutants that the source has the potential to emit in significant amounts. The definition of existing air quality can be satisfied by air measurements from either a state-operated or private network, or by a pre-construction monitoring program that is specifically designed to collect

data in the vicinity of the proposed source. To fulfill the pre-construction monitoring requirement for PSD without conducting on-site monitoring a source may either:

1. Justify that data collected from existing monitoring sites are conservatively representative of the air quality in the vicinity of the proposed Project site;

2. Demonstrate through modeling the ambient impacts from the proposed Project is less than the de minimis levels established by the EPA (see **Table 4-2**).

As such, if the source-only modeled impacts are greater than the de minimis monitoring concentrations found in **Table 4-2,** the proposed Project proposes to use the background air quality data summarized in **Section 4.1** to quantify existing air quality for the proposed Project site.

Table 4-2 De Minimis Monitoring Concentrations

Pollutant	Averaging Time		
	Annual *µg/m³*	**24-hour** *µg/m³*	**8-hour** *µg/m³*
NO_2	14	-	-
CO	-	-	575
PM_{10}	-	10	-
O_3	-		VOC emission increase > 100 TPY

5.0 Additional Impact Analysis

In accordance with 9 VAC 5-80-1755, additional impacts must be addressed for projects subject to PSD review. The various components of the additional impact analyses are discussed below.

5.1 Class I Area Impact Analysis

PSD regulations require that facilities within 100 km of a PSD Class I area perform a modeling evaluation of the ambient air quality in terms of Class I PSD increments and Air Quality Related Values (AQRVs). In addition, large projects beyond 100 km (but less than 300 km) from the nearest Class I area may be requested to conduct an evaluation of air quality impacts by the Federal Land Managers (FLMs).

There are 5 Class I areas within 300 km of the proposed Project site. **Figure 5-1** shows the location of the Class I areas in relationship to the proposed Project site. These Class I areas are as follows:

1. Shenandoah National Park, approximately 57 km away to the southwest;
2. Dolly Sods Wilderness Area, approximately 152 km away to the west;
3. Otter Creek Wilderness Area, approximately 175 km away to the west;
4. James River Face Wilderness Area, approximately 227 km away to the southwest; and
5. Brigantine National Wildlife Refuge, approximately 271 km away to the east-northeast.

Based on recent communications with the National Park Service (NPS), United States Forest Service (USFS) and United States Fish and Wildlife Service (FWS), an AQRV analysis (including regional haze) is not being requested for this Project based on the low ratio of proposed emissions (Q) relative to the large distances (D) from the proposed Project location to the nearest Class I areas. The Q/D ratio for each class I area is presented in **Table 5-1**. As shown in **Table 5-1**, the proposed Project's Q/D is less than 10 which is the recommended screening exemption level in the Federal Land Managers' Air Quality Related Values Work Group Phase 1 Report (Revised 2010) (FLAG 2010). Therefore, the proposed Class I area Analysis will address only PSD increment consumption at the nearby Class I areas. **Appendix C** contains communications from the NPS, USFS, and FWS regarding their intentions not to request an AQRV analysis or comment any further on the permitting of this proposed Project.

Table 5-1 Class I Q/D Ratios

Class I Area	Project Emissions[(1)] of SO_2,H_2SO_4, NO_X, and PM_{10} (TPY)	Distance from Proposed Project (km)	Q/D Ratio
Shenandoah National Park	SO_2 = 6.3 H_2SO_4 = 3.4 NO_X = 176.1 PM_{10} = 131.4 **Total = 317.2**	57	5.6
Dolly Sods Wilderness		152	2.1
Otter Creek Wilderness		175	1.8
James River Face Wilderness		227	1.4
Brigantine National Wildlife Refuge		271	1.2

(1) Project emission represent short-term potential converted to TPY assuming 8760 hrs/yr of duct firing for 2 GE 7FA.05 turbines. Siemens turbines have lower maximum hourly emissions.

As such, CALPUFF (Version 5.8) (Scire 2000a) and three years (2001-2003) of VISTAS CALMET (Scire 2000b) meteorological data sub-domain #5 will be used to assess PSD increment consumption and deposition at Shenandoah NP. CALPUFF will be used to assess the impacts at Shenandoah NP since the nearest boundary of the Park is greater than 50 km away.

AECOM has already re-processed the VISTAS CALMET data to be consistent with the recommended setting in the August 2009 EPA-FLM Clarification Memo (available at: http://www.epa.gov/scram001/CALMET%20CLARIFICATION.pdf) and the most recent model version (CALMET Version 5.8). As customary for CALPUFF long-range transport Class I area impact analysis, the auxiliary boiler, emergency generator and other ancillary equipment will not be included in the modeling.

The CALPUFF modeling will utilize the US EPA recommended model defaults along with the MREG=1 switch. Hourly background ozone concentrations will be based upon VISTAS datasets and 1.0 ppb will be used for the background ammonia concentration.

Results of the CALPUFF modeling analysis will include modeled concentrations for NO_2, PM_{10}, and $PM_{2.5}$ as compared to Class I area SILs (shown in **Table 5-2**). Primary plus secondary $PM_{2.5}$ impacts will be accounted for. It is anticipated that the Class I area modeling will result in modeled impacts that are less than the SILs for all pollutants and averaging periods with the exception of $PM_{2.5}$.

VA DEQ will be contacted to gather an inventory of $PM_{2.5}$ increment consuming sources in northern Virginia. There should be a very small list of $PM_{2.5}$ increment consuming sources due to the baseline date being established in October 2011. Data from other states will be gathered as necessary.

Table 5-2 Criteria Pollutant Class I Significant Impact Levels

Pollutant	Averaging Time (1)		
	Annual $\mu g/m^3$	**24-hour** $\mu g/m^3$	**3-hour** $\mu g/m^3$
NO_2	0.1	-	-
PM_{10}	0.2	0.3	-
$PM_{2.5}$	0.06	0.07	

(1) High 1st high modeled concentration.

5.2 Visible Plume Analysis

The PSD regulation requires an analysis of visibility impairment (i.e., plume blight) at Class I areas within 50 kilometers of the proposed Project site. As discussed earlier and in Section 5.1, the nearest Class I area is more than 57 km of the proposed Project site. Therefore, a visible plume analysis is not warranted. Furthermore, the FLMs have waived any requirements to conduct an analysis of visible plumes or regional haze at any of the Class I areas within 300 km of the proposed Project site.

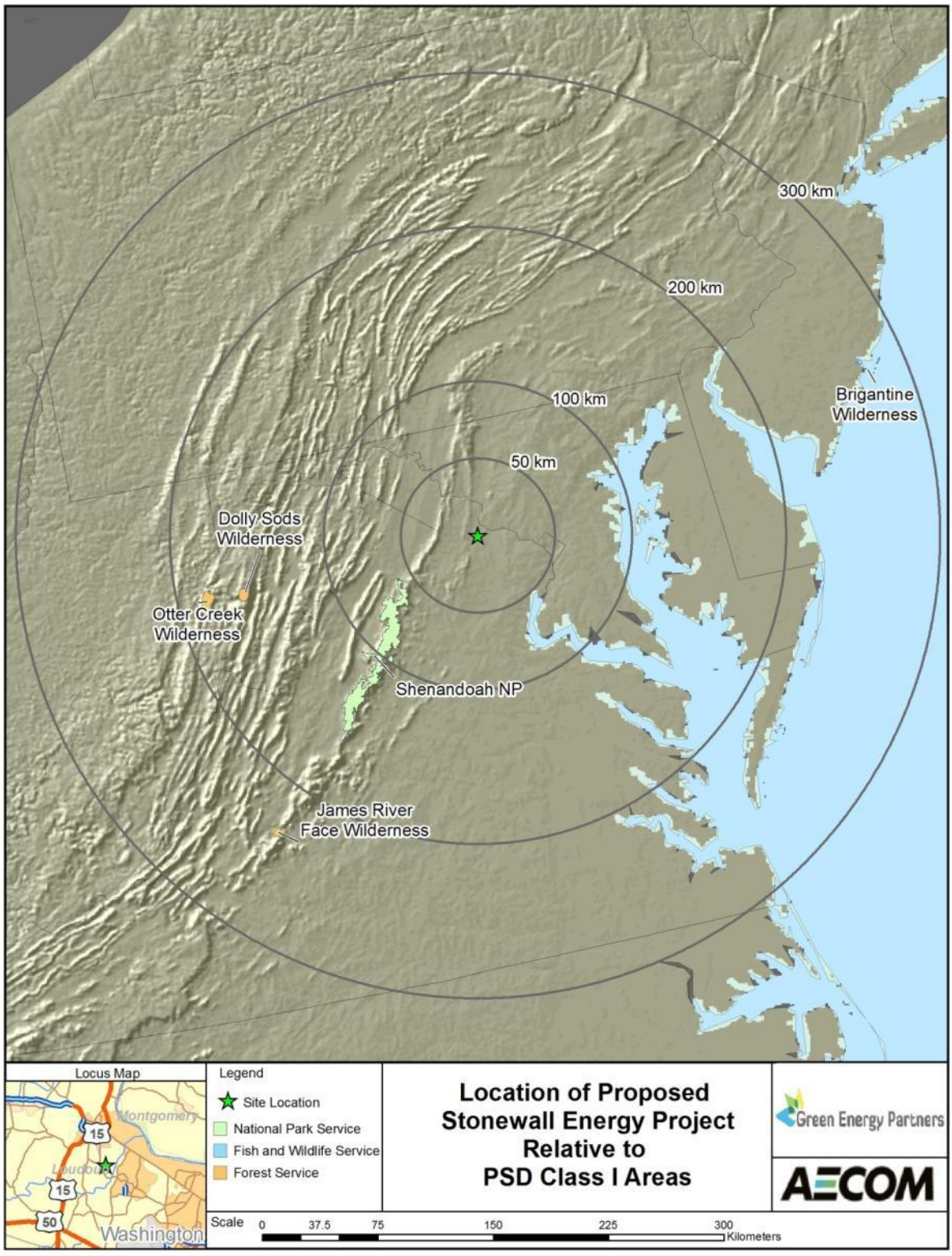
In addition to the Class I area analysis there is a requirement, as part of the PSD additional impacts analysis, for a visibility analysis to be performed within the area affected by the facility. In that regard, VA DEQ will be consulted to identify a nearby state park or other sensitive area in the Project vicinity for which a visible plume analysis will be conducted.

The facility will also be subject to plume abatement as a requirement of the approval conditions which will be enforced via opacity limits.

The visible plume analysis will be conducted with the most current version of USEPA's screening model VISCREEN to determine if project emissions during normal operations have the potential to cause visibility impairment. VISCREEN will be applied with the guidance provided in USEPA's Workbook for Plume Visual Impact Screening and Analysis (1992) ("Workbook"). As such the VISCREEN model will be applied to estimate two visual impact parameters, plume perceptibility (ΔE) and plume contrast (Cp). Screening-level guidance indicates that values above 2.0 for ΔE and +/- 0.05 for Cp are considered perceptible. The Workbook offers two levels of analysis. Level 1 screening analysis which is the most simplified and conservative approach employing default meteorological data with no site-specific conditions. The Level 2 analysis takes into account representative meteorological data and site-specific conditions. According to Figure 9 in the "Workbook", the background visual range recommended for the Project area is 25 kilometers. This background visual range will be used for both the Level 1 and Level 2 (if required) screening analyses.

Initially, a Level 1 analysis will be conducted and if the VISCREEN results are less than the ΔE and Cp screening values, no further analysis will be required. If necessary, a Level 2 analysis will be conducted in accordance with the recommendations in the Workbook.

Figure 5-1 Class I Areas within 300 km of the Proposed Project Site



5.3 Growth Analysis

A growth analysis examines the potential emissions from secondary sources associated with the proposed Project. While these activities are not directly involved in Project operation, the emissions involve those that can reasonably be expected to occur; for instance, industrial, commercial, and residential growth that will occur in the Project area due to the Project itself. Secondary emissions do not include any emissions which come directly from a mobile source, such as emissions from the tailpipe of any on-road motor vehicle or the propulsion of a train (USEPA 1990). They also do not include sources that do not impact the same general area as the source under review.

The work force expected for the Project will range from 600-700 jobs during various phases of construction. It is expected that a significant regional construction force is already available to build the Project. Therefore, it is expected that no new housing, commercial or industrial construction will be necessary to support the Project during the two-year construction schedule. The Project will also require approximately 25 to 30 permanent positions. Individuals that already live in the region will perform a number of these jobs. For any new personnel moving to the area, no new housing requirements are expected. Further, due to the small number of new individuals expected to move into the area to support the Project and existence of some commercial activity in the area, new commercial construction will not be necessary to support the Project's permanent work force. In addition, no significant level of industrial related support will be necessary for the Project, thus industrial growth is not expected.

Based on the growth expectations above, no new significant emissions from secondary growth during Project construction and operation are anticipated.

5.4 Soils and Vegetation Analysis

The US EPA guidance document for soils and vegetation, *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (EPA 1980), was last updated in 1980 and does not necessarily represent the current state of knowledge. Therefore, the screening methodology provided in that document of comparing the air quality modeling emission results to the "vegetation sensitivity thresholds" will be supplemented with a more robust soils and vegetation analysis as described below.

Vegetation Assessment

As an indication of whether emissions from the proposed Project will significantly impact the surrounding vegetation (i.e., cause acute or chronic exposure to each evaluated pollutant), the modeled emission concentrations will be compared against both a range of injury thresholds found in various peer-reviewed research articles that specifically examine effects of different pollutants on vegetation as well as established NAAQS secondary standards. Since the NAAQS secondary standards were set to protect public welfare, including protection against damage to crops and vegetation, comparing the modeled emissions to these standards will provide some indication if potential impacts are likely to be significant. However, given that secondary standards for some criteria pollutants are under review, comparison to the secondary NAAQS may not be definitive.

Pollutant emissions examined will consist of sulfur dioxide (SO_2), nitrogen oxides (NO_x), particulate matter (PM) and carbon monoxide (CO). Resultant modeled concentrations from the Project sources alone will be compared against the vegetation sensitivity thresholds listed in the aforementioned 1980 EPA guidance, secondary NAAQS, and plant injury thresholds found in the literature. **Table 5-3** below illustrates injury threshold ranges determined through a review of available research.

Soil Assessment

To determine whether the Project emissions could adversely affect the soil in the vicinity of the Project, the type of soil surrounding the Project site will first be established. The soil type will be determined from data collected from the U.S. Department of Agriculture, National Resource Conservation Service's (NRCS), Soil Survey Geographic (SSGUGO) database[2] and the NRCS Web Soil Survey tool[3]. Soil types within Loudoun and Montgomery Counties will be examined. These counties were chosen because the Project site is within Loudoun County, and Montgomery County is within a 10 km radius of the Project site. The evaluation will be based on the predominate soil type and its ability to absorb the acidifying effects of pollutant emissions such as NO_X as provided in EPA's 1980 guidance supplemented with threshold levels found in the literature.

Table 5-3 Injury Threshold for Vegetation

Pollutants	**Injury Threshold (Dose)[1]** (µg/m^3)	**NAAQS** (µg/m^3)	**EPA's 1980 Screening Concentration[2]** (µg/ m^3)
NO_X (as NO_2)	280 – 38,000 (1 hour to long term)	100 (annual)	94 (annual)
			3,760 (4 hour)
			564 (1 month)
PM (as PM_{10})	See NAAQS	150 (24 hour)	None
CO	None		1,800,000 (weekly)

1. Values suggested in the Spiritwood Station PSD permit application; see http://www.greatriverenergy.com/makingelectricity/newprojects/spiritwood_applicationsandreports.html
2. "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals". EPA 450/2-81-078, December 1980.

5.5 Air Toxics Analysis

As stated in Section 2.3.2, modeling analyses will be performed for the sources subject to requirements under 9 VAC 5-60-300 on a facility-wide basis for those pollutants with emission levels that are above the VA DEQ exemption level. The modeled concentrations will be compared to the corresponding pollutant Significant Ambient Air Concentration (SAAC).

[2] U.S. Department of Agriculture, National Resource Conservation Service's (NRCS), Soil Survey Geographic (SSGUGO) database . Accessed 17 December 2009. http://soils.usda.gov/survey/geography/ssurgo/

[3] U.S. Department of Agriculture, National Resource Conservation Service's Web Soil Survey Tool. Accessed 17 December 2009. http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

6.0 Submittal of Analysis Results

The findings of the air quality impact analyses will be submitted to VA DEQ in a formal report for review and approval. The report will address the following:

- Source Data: Source data required for evaluation of Project impacts will be provided for both turbines. This will include criteria pollutant emission rates and stack exhaust parameters.
- Choice of Models: The chosen models including version numbers and selected options will be discussed.
- Receptor Data: A plot of the receptor grid used in the AERMOD analysis will be provided with the final application document.
- Meteorology: The meteorological conditions used in the analysis will be documented. The use of Richmond Airport, Virginia and Sterling, Virginia upper air meteorological data will be discussed.
- Modeling Summary: Results of the modeling analyses for all operating scenarios and both turbine options will be documented and summarized.
- Compliance with NAAQS and PSD Increments: A demonstration of compliance with these standards will be presented and supported in the report in text, tabular and/or graphical format.
- Additional impacts: The additional impacts analysis will consist of a Class I Area impact analysis, an analysis of visible plume impacts, a secondary growth analysis, an analysis on impacts of soils and vegetation, and air toxics modeling.
- Model Output and Databases: The model input and output files will be provided to VA DEQ on CD/DVD-ROM. Also, BPIP-Prime input and output files will be provided. The final modeling report will also include graphics (e.g., contour maps) that show the extent of the air quality impacts for the worst case year for each pollutant and averaging period for each turbine. The figures will utilize a base map that is readily understandable by the general public. Each map will clearly identify the proposed plant location relative to these air quality impacts.

7.0 References

National Park Service, 2010. Phase I Report of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Revised 2010. National Park Service, Air Resources Division; U.S. Forest Service, Air Quality Program; U.S. Fish and Wildlife Service, Air Quality Branch. http://www.nature.nps.gov/air/Pubs/pdf/flag/FLAG_2010.pdf.

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US EPA 1988: Workbook for Plume Visual Impact Screening and Analysis. EPA-450/4-88-015.

US EPA 1992. Workbook for Visual Impact Screening and Analysis (Revised). EPA-450/R-92-023.

US EPA 2004a. User's Guide for the AMS/EPA Regulatory Model (AERMOD). EPA-454/B-03-001 (September 2004 – Addendum March 2011). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

US EPA 2004b. User's Guide for the AERMOD Meteorological Preprocessor (AERMET). (EPA-454/B-03-002, November 2004 – Addendum February 2011). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

US EPA 2004c. User's Guide for the AERMOD Terrain Preprocessor (AERMAP). (EPA-454/B-03-003, October 2004 – Addendum March 2011). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

US EPA 2008. AERSURFACE User's Guide. (EPA-454/B-08-001, January 2008). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

U.S. EPA 2005. Guideline on Air Quality Models (Revised). Codified in the Appendix W to 40 CFR Part 51. Office of Air Quality Planning and Standards, Research Triangle Park, NC. November 2005.

US EPA 2009. AERMOD Implementation Guide (Revised). US EPA, Research Triangle Park, NC. March 19, 2009.

US EPA 2010. Modeling Procedures for Demonstrating Compliance with the $PM_{2.5}$ NAAQS. (March 23, 2010). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. Available at: http://www.epa.gov/ttn/scram/Official%20Signed%20Modeling%20Proc%20for%20Demo%20Compli%20w%20PM2.5.pdf

US EPA 2011. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS. (March 1, 2011). Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina. Available at: http://www.epa.gov/ttn/scram/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

Appendix A

Preliminary Site Plans

NA_FORMATS.CEL AC-ESTD_NA 07/17/08

ITEM	DESCRIPTION
1	WATER STORAGE TANK
2	ELEVATOR
3	AQUEOUS AMMONIA STORAGE TANK WITH SUNSHADE
4	FIRE PUMPS
5	ADMINISTRATION / WAREHOUSE / MAINTENACE BUILDING
6	FUEL GAS EQUIPMENT
7	EMERGENCY DIESEL GENERATOR
8	CRYSTALLIZER FEED TANK WITH MIXER
9	AUXILIARY BOILER
10	COOLING TOWER
11	DEMINERALIZED WATER STORAGE TANK & PUMPS
12	GUARD HOUSE/VISITOR CENTER
13	HYDROGEN TRAILER
14	WATER TREATMENT BUILDING
15	COMBUSTION TURBINE (CT)
16	COMBUSTION TURBINE GENERATOR (CTG)
17	STEAM TURBINE (ST)
18	OIL / WATER SEPARATOR
19	RAW WATER EQUIPMENT AREA
20	SWITCH YARD 1 (230 KV)
21	SWITCH YARD 2 (230 KV) (BY OWNER)
22	HEAT RECOVERY STEAM GENERATOR (HRSG) STACK
23	CONTINUOUS EMISSIONS MONITORING SYSTEM (CEMS)
24	RENTAL DEMINERALIZATION UNITS
25	SERVICE / FIRE WATER STORAGE TANK
26	GAS METERING STATION/CHROMATOGRAPH/REDUCING STATION
27	ZLD EQUIPMENT
28	COOLING TOWER BLOWDOWN TANK & PUMPS
29	STEAM TURBINE GENERATOR (STG)
30	SUMP PUMPS
31	WATER TREATMENT LAB
32	ZLD / WATER TREATMENT POWER DISTRIBUTION CENTER
33	FILTER PRESS
34	CHEMICAL STORAGE AREA
35	BOILER FEED PUMPS

TIE POINTS:

1. RAW WATER
2. SEWER
3. NATURAL GAS
4. 230kV OWNER TIE-IN
5. POTABLE WATER TIE-IN

NO.	DATE	REVISIONS	BY	CHK	DES SUPV.	ENGR.	PROJ ENGR	APPR
	/ /							
E	7/10/12	ISSUED FOR INFORMATION	CB	SW	SW	-	DAC	-
D	7/3/12	ISSUED FOR INFORMATION	CB	DB	DB FOR SW	-	DAC	-
C	6/29/12	ISSUED FOR INFORMATION	CB	SW	SW	-	DAC	-
B	6/26/12	ISSUED FOR INFORMATION	CB	SW	SW	-	DAC	-
A	6/21/12	ISSUED FOR PROPOSAL	CB	SW	SW	-	DAC	-

SCALE AS NOTED | DATE | DESIGNED | DRAWN | CHIEF ENGR.

BECHTEL

DEDICATED TO SAFETY EXCELLENCE - ZERO ACCIDENTS

FREDERICK, MARYLAND

STONEWALL ENERGY PROJECT

PLOT PLAN

JOB NO.	DRAWING NO.	REV.
25768-001	P1-0010-00001	E

34"X44"E SIZE

PSC- : :

DFN=[ ] . DFN=[ ] .

LEVELS 11111111112222222222333333333344444444445555555555666 123456789012345678901234567890123456789012345678901234567890123

8 7 6 5 4 3 2 1

H G F E D C B A

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Appendix B

30-years of Monthly Precipitation Data from Dulles International Airport

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1982	2.10	4.09	3.48	2.82	3.57	5.49	2.11	3.37	4.22	2.21	2.88	2.26
1983	1.41	3.74	4.20	7.24	3.63	4.02	0.94	1.34	2.95	6.00	5.07	5.67
1984	1.43	4.13	5.81	5.01	4.23	2.19	2.46	10.72	1.49	1.73	3.64	1.25
1985	2.32	3.73	1.70	0.33	4.82	1.14	2.34	3.35	2.96	4.06	5.27	0.92
1986	1.59	3.17	1.13	3.01	1.19	1.41	1.86	5.72	1.05	1.30	4.18	4.83
1987	4.53	2.47	1.46	4.61	2.33	3.38	3.05	0.96	8.11	2.51	5.03	2.35
1988	2.47	2.06	2.31	2.35	10.26	0.52	7.12	3.92	1.81	1.60	4.48	0.92
1989	2.65	2.50	4.01	2.70	7.71	5.75	5.99	0.76	3.14	4.73	2.69	1.73
1990	3.14	1.65	2.78	5.06	4.37	1.77	5.42	5.56	1.49	6.53	2.56	5.00
1991	2.68	0.81	5.16	1.80	1.51	6.59	2.65	0.99	3.26	1.37	2.70	4.54
1992	2.13	2.26	3.23	3.15	3.82	2.88	7.23	1.33	5.55	2.81	5.24	4.74
1993	2.72	2.74	7.65	5.61	2.85	1.77	2.06	4.69	4.66	2.15	6.28	3.78
1994	4.12	3.61	6.71	1.71	3.19	5.82	5.75	4.63	3.40	1.05	1.87	2.43
1995	4.18	1.80	1.39	2.15	5.13	3.25	4.25	2.02	2.74	6.51	4.76	2.05
1996	5.61	2.62	3.52	3.69	7.07	4.88	5.89	4.17	7.72	3.98	3.76	5.22
1997	2.17	2.16	4.78	2.18	2.87	2.36	1.38	5.33	3.16	2.75	5.49	1.92
1998	5.43	5.83	5.60	2.93	4.52	5.87	1.31	0.44	1.25	1.50	1.21	1.53
1999	5.39	2.62	3.44	2.68	2.22	3.00	2.57	5.43	9.32	2.55	1.72	2.67
2000	2.50	1.92	3.35	4.37	2.57	4.02	4.29	5.93	4.20	0.06	1.57	2.06
2001	2.54	1.69	4.15	2.16	5.69	4.83	4.24	4.52	3.39	1.42	0.81	1.56
2002	1.22	0.46	3.48	3.45	4.74	3.61	2.64	2.91	2.84	5.04	4.13	3.61
2003	2.69	6.27	3.69	2.72	8.71	8.34	6.06	5.56	7.26	4.63	5.20	4.57
2004	1.41	1.93	2.06	5.04	3.06	3.72	3.72	3.79	5.80	1.04	4.10	3.02
2005	3.14	1.41	3.93	4.35	4.86	1.93	7.86	2.32	0.15	9.22	2.49	2.92
2006	2.39	2.39	0.07	4.87	1.81	11.79	2.45	1.24	7.12	4.82	5.31	1.74
2007	2.12	2.54	2.93	3.39	0.34	2.93	1.75	1.67	1.40	3.52	1.49	2.97
2008	1.26	2.67	2.47	6.22	9.38	4.22	2.19	2.48	7.19	1.31	2.02	2.61
2009	2.64	0.35	2.41	4.13	10.26	6.69	2.18	2.75	1.83	5.70	3.71	5.97
2010	2.02	4.63	3.36	1.30	5.43	1.29	4.17	4.43	6.16	2.39	2.50	1.47
2011	1.87	2.21	5.08	5.21	3.29	1.41	2.58	3.74	7.93	6.28	2.18	4.46

(1) precipitation amount represent monthly totals in inches.

Appendix C

FLM AQRV Waiver

Connors, Jeffrey

From:	Andrea_Stacy@nps.gov
Sent:	Tuesday, July 03, 2012 12:38 PM
To:	Kiss, Michael (DEQ)
Cc:	Hall, Bob; Connors, Jeffrey; Jim_Schaberl@nps.gov; John_Notar@nps.gov; jordandim@aol.com; jxu@bechtel.com; Lute, Robert (DEQ); Deshpande, Seemantini; Darton, Terry (DEQ); Valentour, Thomas (DEQ); Campbell, William; wtcaudle@bechtel.com
Subject:	RE: Call Number: Stonewall Energy Project

Mike,

Thank you for submitting the more detailed emissions summary for the Stonewall Energy Project. This allows us to confirm the Q/d calculations.
Green Energy Partners/Stonewall LLC is proposing to construct a 650 MW
(Nominal) 2 on 1 combined cycle natural gas-fired power station, to be located in Loudoun County, Virginia. Based on the proposed emission increases and the distance from Shenandoah National Park, as described in your email, and powerpoint, the NPS does not anticipate that modeling would show any significant additional impacts to air quality related values
(AQRV) in this park. Therefore, we are not requesting that the applicant complete a Class I AQRV modeling analysis. However, we request that the VA DEQ submit a copy of the draft permit and draft engineering and BACT analyses to the NPS when these documents become available. Because we have screened this permit from further AQRV review, we do not feel that a meeting to discuss the analysis is necessary, and do not plan to participate on Monday's call.

Please note that our determination regarding the need for a Class I AQRV analysis does not indicate our agreement with any Class I modeling protocols, results or conclusions that applicants might make independent of Federal Land Manager review. Furthermore, we are only addressing the need for an AQRV analysis in Shenandoah NP; independent determinations will need to be made for Class I areas managed by other federal agencies (i.e. FWS, USFS). The state and/or EPA may have a different opinion regarding the need for a Class I increment analysis.

Finally, if the emissions or nature of the project change significantly, the VA DEQ should contact the NPS to re-evaluate the need for a Class I AQRV analysis. Thank you for involving the NPS in this project review, feel free to contact me if you have any questions.

Andrea Stacy
National Park Service
Air Resources Division
12795 W. Alameda Pkwy
P.O. Box 25287
Denver, CO 80225
andrea_stacy@nps.gov
303-969-2816 (phone)
303-969-2822 (Fax)

"Kiss, Michael
(DEQ)"

<Michael.Kiss@deq.virginia.gov>
07/02/2012 04:55 PM

To "jordandim@aol.com" <jordandim@aol.com>, "wtcaudle@bechtel.com" <wtcaudle@bechtel.com>, "jxu@bechtel.com" <jxu@bechtel.com>, "Bob.Hall@aecom.com" <Bob.Hall@aecom.com>, "william.campbell@aecom.com" <william.campbell@aecom.com>, "Seemantini.Deshpande@aecom.com" <Seemantini.Deshpande@aecom.com>, "Jeffrey.Connors@aecom.com" <Jeffrey.Connors@aecom.com>, "Darton, Terry (DEQ)" <Terry.Darton@deq.virginia.gov>, "Valentour, Thomas (DEQ)" <Thomas.Valentour@deq.virginia.gov>, "Lute, Robert (DEQ)" <Robert.Lute@deq.virginia.gov>, "Andrea_Stacy@nps.gov" <Andrea_Stacy@nps.gov>, "John_Notar@nps.gov" <John_Notar@nps.gov>, "Jim_Schaberl@nps.gov" <Jim_Schaberl@nps.gov>

cc

Subject
RE: Call Number: Stonewall Energy Project

All,

See attached. Slide 8 of the presentation is updated to include the proposed hourly rates of the equipment. This was done to more clearly show how the Q/d calculation was performed.

Best regards,
Mike

From: jordandim@aol.com [jordandim@aol.com]

Sent: Monday, July 02, 2012 4:48 PM
To: Kiss, Michael (DEQ); wtcaudle@bechtel.com; jxu@bechtel.com; Bob.Hall@aecom.com; william.campbell@aecom.com; Seemantini.Deshpande@aecom.com; Jeffrey.Connors@aecom.com; Darton, Terry (DEQ); Valentour, Thomas (DEQ); Lute, Robert (DEQ); Andrea_Stacy@nps.gov; John_Notar@nps.gov; Jim_Schaberl@nps.gov
Subject: Re: Call Number: Stonewall Energy Project

Thank you,Confirmed,

Jordan

-----Original Message-----
From: Kiss, Michael (DEQ) (DEQ) <Michael.Kiss@deq.virginia.gov>
To: Kiss, Michael (DEQ) (DEQ) <Michael.Kiss@deq.virginia.gov>; Caudle, William <wtcaudle@bechtel.com>; Xu, Jingjing <jxu@bechtel.com>; jordandim <jordandim@aol.com>; Hall, Bob <Bob.Hall@aecom.com>; Campbell, William <william.campbell@aecom.com>; Deshpande, Seemantini <Seemantini.Deshpande@aecom.com>; Connors, Jeffrey <Jeffrey.Connors@aecom.com>; Darton, Terry (DEQ) (DEQ) <Terry.Darton@deq.virginia.gov>; Valentour, Thomas (DEQ) (DEQ) <Thomas.Valentour@deq.virginia.gov>; Lute, Robert (DEQ) (DEQ) <Robert.Lute@deq.virginia.gov>; Andrea_Stacy <Andrea_Stacy@nps.gov>; 'John_Notar@nps.gov' <John_Notar@nps.gov>; 'Jim_Schaberl@nps.gov' <Jim_Schaberl@nps.gov>
Sent: Mon, Jul 2, 2012 3:52 pm
Subject: Call Number: Stonewall Energy Project

The call is scheduled for the following:

Monday 7/9: 10:30 - 12:00 MDT (12:30-2:00 EDT)

Please note the time zones.

The call number is:

804-698-4509

I look forward to speaking with everyone then.

Best regards,
Mike

Mike Kiss
Director, Office of Air Quality Assessments Air Division Virginia DEQ - Central Office
629 East Main Street
P.O. Box 1105, Richmond, VA 23218
Phone: (804) 698-4460

Air Quality Assessments Website (new website) http://www.deq.virginia.gov/Programs/Air/AirQualityAssessments.aspx

From: Kiss, Michael (DEQ)
Sent: Monday, June 18, 2012 3:24 PM
To: 'Martha_Bogle@nps.gov'; 'Jim_Schaberl@nps.gov'; 'Don_Shepherd@nps.gov'; 'John_Notar@nps.gov'; 'mhyzer@fs.fed.us'; 'elhuffman@fs.fed.us'; '

mpitrolo@fs.fed.us'; 'Andrea_Stacy@nps.gov'; 'meredith_bond@fws.gov'; '
Jill_Webster@fws.gov'
Cc: Caudle, William; Xu, Jingjing; jordandim@aol.com; Hall, Bob; Campbell, William; Deshpande, Seemantini; 'Connors, Jeffrey'; Darton, Terry (DEQ); Valentour, Thomas (DEQ); Lute, Robert (DEQ)
Subject: Stonewall Energy Project

FLM Contacts,

I'm writing to solicit your feedback on the need for a PSD pre-application call and any subsequent Class I area AQRV analyses for the Green Energy Partners / Stonewall LLC "Stonewall Energy Project." Specific information is provided in the attached presentation. The proposal is to construct a
650 MW (nominal) 2-on-1 combined cycle power station that fires natural gas only. This is actually an amendment to a previous project that we already spoke about in 2010. The design of the project has changed so we wanted to revisit the details with you.

Below are the approximate distances to each Class I area within 300 kilometers of the facility.

USFS Class I areas

Dolly Sods Wilderness Area, approximately 152 km away to the west Otter Creek Wilderness Area, approximately 175 km away to the west James River Face Wilderness Area, approximately 227 km away to the southwest

NPS Class I areas

Shenandoah National Park - 57 km away to the southwest

FWS Class I areas

Brigantine National Wildlife Refuge, approximately 271 km away to the east-northeast

The emission calculations in the presentation are draft and DEQ will inform you if the applicability status of any pollutant changes when the calculations are finalized.

Again, we would like to hear feedback from each FLM on this project and your need for (1) the pre-application meeting and (2) the Class I area AQRV analysis. The applicant would like to submit its revised application as soon as possible because it is a tight permitting schedule.

I've provided a Doodle poll below if you would like to participate on a call. Please enter your schedule as soon as possible. All times are EDT.

http://www.doodle.com/ra4ek3bzx3y6amfi

Lastly, please forward this e-mail to anyone that needs to be copied and that I may have inadvertently left off the distribution list. Thanks in advance for your help.

Best regards,
Mike

Mike Kiss
Director, Office of Air Quality Assessments Air Division Virginia DEQ - Central Office
629 East Main Street
P.O. Box 1105, Richmond, VA 23218

Phone: (804) 698-4460

Air Quality Assessments Website (new website) http://www.deq.virginia.gov/Programs/Air/AirQualityAssessments.aspx

Connors, Jeffrey

From:	Huffman, Edward L -FS <elhuffman@fs.fed.us>
Sent:	Wednesday, June 20, 2012 10:24 AM
To:	Kiss, Michael (DEQ); 'Martha_Bogle@nps.gov'; 'Jim_Schaberl@nps.gov'; 'Don_Shepherd@nps.gov'; John_Notar@nps.gov; Hyzer, Maureen -FS; Pitrolo, Melanie -FS; 'Andrea_Stacy@nps.gov'; 'meredith_bond@fws.gov'; Jill_Webster@fws.gov
Cc:	Caudle, William; Xu, Jingjing; jordandim@aol.com; Hall, Bob; Campbell, William; Deshpande, Seemantini; Connors, Jeffrey; Darton, Terry (DEQ); Valentour, Thomas (DEQ); Lute, Robert (DEQ); Sams, Charles E -FS; Thompson, Clyde N -FS; Clark, Devela J -FS
Subject:	RE: Stonewall Energy Project

Mike,

The US Forest Service, Federal Land Manager for Dolly Sods, Otter Creek and James River Face Class I Wilderness areas has received the revised modeling protocol for the proposed Green Energy Partners / Stonewall LLC "Stonewall Energy Project" in/near Leesburg, Virginia. Based on the emission rates in the protocol and distances to the Class I areas we anticipate that modeling would not show any significant additional impacts to air quality related values (AQRV) at the Class I areas administered by the US Forest Service. Therefore, we are not requesting that a Class I AQRV analysis be included in the PSD permit application. We understand that the Virginia Department of Environmental Quality and/or US EPA may have a different opinion regarding the need for a Class I increment analysis.

Class I Area	Distance from Facility in kilometers	Annual PTE in tpy [1/]
Dolly Sods	152	318
Otter Creek	175	
James River Face	227	

1/ Based on 24-hour maximum allowable emissions of sulfur dioxide, nitrogen oxides, total fine particulate matter and sulfuric acid mist from all proposed new sources at the facility.

Our waiver of this analysis does not indicate agreement with any AQRV analysis protocols or conclusions applicants may make independent of Federal Land Manager review. Please note that we are specifically addressing the need for an AQRV analysis for Class I areas managed by the US Forest Service. Should the emissions or the nature of the project change significantly from that presented in the modeling protocol from Green Energy Partners/Stonewall dated on 18 June 2012, please contact us so that we may re-evaluate the project proposal.

Thank you for keeping us informed and involving the USDA Forest Service early in the this revised project review. Even though we do not need to continue to be involved in the permitting process for this facility we would like to receive the final permit when issued (an electronic version is preferred).

Sincerely,

Edward (Tedd) Huffman
Monongahela National Forest Hydrologist and BAER Coordinator
office: 304-636-1800 x192

mobile: 304-642-1580
elhuffman@fs.fed.us

From: Kiss, Michael (DEQ) [mailto:Michael.Kiss@deq.virginia.gov]
Sent: Monday, June 18, 2012 3:24 PM
To: 'Martha_Bogle@nps.gov'; 'Jim_Schaberl@nps.gov'; 'Don_Shepherd@nps.gov'; John_Notar@nps.gov; Hyzer, Maureen -FS; Huffman, Edward L -FS; Pitrolo, Melanie -FS; 'Andrea_Stacy@nps.gov'; 'meredith_bond@fws.gov'; Jill_Webster@fws.gov
Cc: Caudle, William; Xu, Jingjing; jordandim@aol.com; Hall, Bob; Campbell, William; Deshpande, Seemantini; Connors, Jeffrey; Darton, Terry (DEQ); Valentour, Thomas (DEQ); Lute, Robert (DEQ)
Subject: Stonewall Energy Project

FLM Contacts,

I'm writing to solicit your feedback on the need for a PSD pre-application call and any subsequent Class I area AQRV analyses for the Green Energy Partners / Stonewall LLC "Stonewall Energy Project." Specific information is provided in the attached presentation. The proposal is to construct a 650 MW (nominal) 2-on-1 combined cycle power station that fires natural gas only. This is actually an amendment to a previous project that we already spoke about in 2010. The design of the project has changed so we wanted to revisit the details with you.

Below are the approximate distances to each Class I area within 300 kilometers of the facility.

USFS Class I areas

Dolly Sods Wilderness Area, approximately 152 km away to the west
Otter Creek Wilderness Area, approximately 175 km away to the west
James River Face Wilderness Area, approximately 227 km away to the southwest

NPS Class I areas

Shenandoah National Park - 57 km away to the southwest

FWS Class I areas

Brigantine National Wildlife Refuge, approximately 271 km away to the east-northeast

The emission calculations in the presentation are draft and DEQ will inform you if the applicability status of any pollutant changes when the calculations are finalized.

Again, we would like to hear feedback from each FLM on this project and your need for (1) the pre-application meeting and (2) the Class I area AQRV analysis. The applicant would like to submit its revised application as soon as possible because it is a tight permitting schedule.

I've provided a Doodle poll below if you would like to participate on a call. Please enter your schedule as soon as possible. All times are EDT.

http://www.doodle.com/ra4ek3bzx3y6amfi

Lastly, please forward this e-mail to anyone that needs to be copied and that I may have inadvertently left off the distribution list. Thanks in advance for your help.

Best regards,
Mike

Mike Kiss
Director, Office of Air Quality Assessments
Air Division
Virginia DEQ - Central Office
629 East Main Street
P.O. Box 1105, Richmond, VA 23218
Phone: (804) 698-4460

Air Quality Assessments Website (new website)
http://www.deq.virginia.gov/Programs/Air/AirQualityAssessments.aspx

Connors, Jeffrey

From: Kiss, Michael (DEQ) <Michael.Kiss@deq.virginia.gov>
Sent: Thursday, June 21, 2012 3:18 PM
To: Caudle, William; Xu, Jingjing; jordandim@aol.com; Hall, Bob; Campbell, William; Deshpande, Seemantini; Connors, Jeffrey; Darton, Terry (DEQ); Valentour, Thomas (DEQ); Lute, Robert (DEQ)
Subject: FW: Stonewall Energy Project

FYI.

Mike Kiss
Director, Office of Air Quality Assessments
Air Division
Virginia DEQ - Central Office
629 East Main Street
P.O. Box 1105, Richmond, VA 23218
Phone: (804) 698-4460

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http://www.deq.virginia.gov/Programs/Air/AirQualityAssessments.aspx

---

From: Jill_Webster@fws.gov [mailto:Jill_Webster@fws.gov]
Sent: Wednesday, June 20, 2012 1:21 PM
To: Kiss, Michael (DEQ)
Subject: Re: Stonewall Energy Project

Hi Mike,

Based on the emissions and distance to the Brigantine Wilderness Area (as provided in the attached documentation), the Fish and Wildlife Service does not anticipate that the modeling would show any significant additional impacts at the Class I Area. Therefore, we are not requesting any AQRV analyses be included in the permit application and do not need to participate in a pre-application meeting.

However, should the project or emissions change again, please contact me directly so that we might re-evaluate the proposed project.

Thank you for keeping us informed and in involving the Fish and Wildlife Service in the project review.

Jill Webster, Environmental Scientist
US Fish and Wildlife Service
National Wildlife Refuge System
Branch of Air Quality
7333 W. Jefferson Ave., Suite 375
Lakewood, CO 80235-2017
(303) 914-3804
fax: (303) 969-5444

"Kiss, Michael (DEQ)" <Michael.Kiss@deq.virginia.gov>

06/18/2012 01:26 PM

To '"Martha_Bogle@nps.gov"' <Martha_Bogle@nps.gov>, '"Jim_Schaberl@nps.gov"' <Jim_Schaberl@nps.gov>, '"Don_Shepherd@nps.gov"' <Don_Shepherd@nps.gov>, '"John_Notar@nps.gov"' <John_Notar@nps.gov>, '"mhyzer@fs.fed.us"' <mhyzer@fs.fed.us>, '"elhuffman@fs.fed.us"' <elhuffman@fs.fed.us>,

"'mpitrolo@fs.fed.us'" <mpitrolo@fs.fed.us>, "'Andrea_Stacy@nps.gov'" <Andrea_Stacy@nps.gov>, "'meredith_bond@fws.gov'" <meredith_bond@fws.gov>, "Jill_Webster@fws.gov" <Jill_Webster@fws.gov>

cc "Caudle, William" <wtcaudle@bechtel.com>, "Xu, Jingjing" <jxu@bechtel.com>, "jordandim@aol.com" <jordandim@aol.com>, "Hall, Bob" <Bob.Hall@aecom.com>, "Campbell, William" <william.campbell@aecom.com>, "Deshpande, Seemantini" <Seemantini.Deshpande@aecom.com>, "Connors, Jeffrey" <Jeffrey.Connors@aecom.com>, "Darton, Terry (DEQ)" <Terry.Darton@deq.virginia.gov>, "Valentour, Thomas (DEQ)" <Thomas.Valentour@deq.virginia.gov>, "Lute, Robert (DEQ)" <Robert.Lute@deq.virginia.gov>

Subject Stonewall Energy Project

FLM Contacts,

I'm writing to solicit your feedback on the need for a PSD pre-application call and any subsequent Class I area AQRV analyses for the Green Energy Partners / Stonewall LLC "Stonewall Energy Project." Specific information is provided in the attached presentation. The proposal is to construct a 650 MW (nominal) 2-on-1 combined cycle power station that fires natural gas only. This is actually an amendment to a previous project that we already spoke about in 2010. The design of the project has changed so we wanted to revisit the details with you.

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Dolly Sods Wilderness Area, approximately 152 km away to the west
Otter Creek Wilderness Area, approximately 175 km away to the west
James River Face Wilderness Area, approximately 227 km away to the southwest

NPS Class I areas

Shenandoah National Park - 57 km away to the southwest

FWS Class I areas

Brigantine National Wildlife Refuge, approximately 271 km away to the east-northeast

The emission calculations in the presentation are draft and DEQ will inform you if the applicability status of any pollutant changes when the calculations are finalized.

Again, we would like to hear feedback from each FLM on this project and your need for (1) the pre-application meeting and (2) the Class I area AQRV analysis. The applicant would like to submit its revised application as soon as possible because it is a tight permitting schedule.

I've provided a Doodle poll below if you would like to participate on a call. Please enter your schedule as soon as possible. All times are EDT.

http://www.doodle.com/ra4ek3bzx3y6amfi

Lastly, please forward this e-mail to anyone that needs to be copied and that I may have inadvertently left off

the distribution list. Thanks in advance for your help.

Best regards,
Mike

Mike Kiss
Director, Office of Air Quality Assessments
Air Division
Virginia DEQ - Central Office
629 East Main Street
P.O. Box 1105, Richmond, VA 23218
Phone: (804) 698-4460

Air Quality Assessments Website (new website)
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Appendix D

Site-Specific Adjustment to Land Use for AERSURFACE Modeling

As described in Section 3.4, AERMET was used for the processing of the Dulles International Airport data for the AERMOD modeling. One of the auxiliary steps needed for the meteorological data processing is the determination of appropriate surface characteristics needed by AERMET (surface roughness, Bowen ratio, and albedo) from digit land use data provided as input to the AERSURFACE program.

The current version of AERSURFACE (Version 08009) supports the use of land cover data from the USGS National Land Cover Data 1992 archives (NLCD92). The NLCD92 archive provides data at a spatial resolution of 30 meters based upon a 21-category classification scheme applied over the continental U.S. The AERMOD Implementation Guide recommends that the surface characteristics are determined based on the land use within 1 km from the site where the surface meteorological data were collected. The selection of the land use types assigned in the NLCD92 database will be reviewed and may be altered with justification based upon a site-specific analysis.

As recommended in the AIG for surface roughness, the 1-km radius circular area centered at the meteorological station site can be divided into sectors for the analysis; each chosen sector has a mix of land uses that is different from that of other selected sectors. The land use depiction is shown in Figure D-1 as a aerial photo and in Figure D-2 with digital land use assignments. It is evident from Figure D-2 that the 1-km circle is dominated by the land use category 85 ("urban/recreational grasses"). This type of cover is described[1] as follows:

"Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses." The very low surface roughness lengths involved indicate that these areas are kept well manicured and mowed, such as a lawn[2] with a height of 2 cm. Our review of Figure D-1 indicated that the area in question was not consistent with this characterization.

Further investigation involved a review of photos of the Dulles airport anemometer site in 8 cardinal directions, provided in Figures D-3 through D-10 for directions looking north clockwise through northwest. It is evident from the photos that the nature of the grassland (with occasional shrubs) is such that the area is not consistent with mowed and manicured lawns, but rather natural grasslands such as those used for grazing. The Randerson reference indicates that for grassy areas with a height of about 50 cm (similar to that in the photographs), the roughness length should be about 10 cm. This value matches that for a more appropriate land use category, which is 71 (grasslands/herbaceous). This change was therefore made to the AERSURFACE run by introducing an IF statement in the FORTRAN code that changed the land use category from 85 to 71 for this application.

---

[1] See http://landcover.usgs.gov/classes.php.

[2] The AERSURFACE citation for the grassy area surface roughness values is Table 5.4 in Randerson, D., 1984, "Atmospheric Boundary Layer," in *Atmospheric Science and Power Production*, ed., D. Randerson. Technical Information Center, Office of Science and Technical Information, U.S. Department of Energy, Springfield, VA, 850pp. This table indicates that the surface roughness is about 1/10 of the height of the grass.

Figure D-7-1 Sectors Used for Surface Characteristics at Dulles International Airport

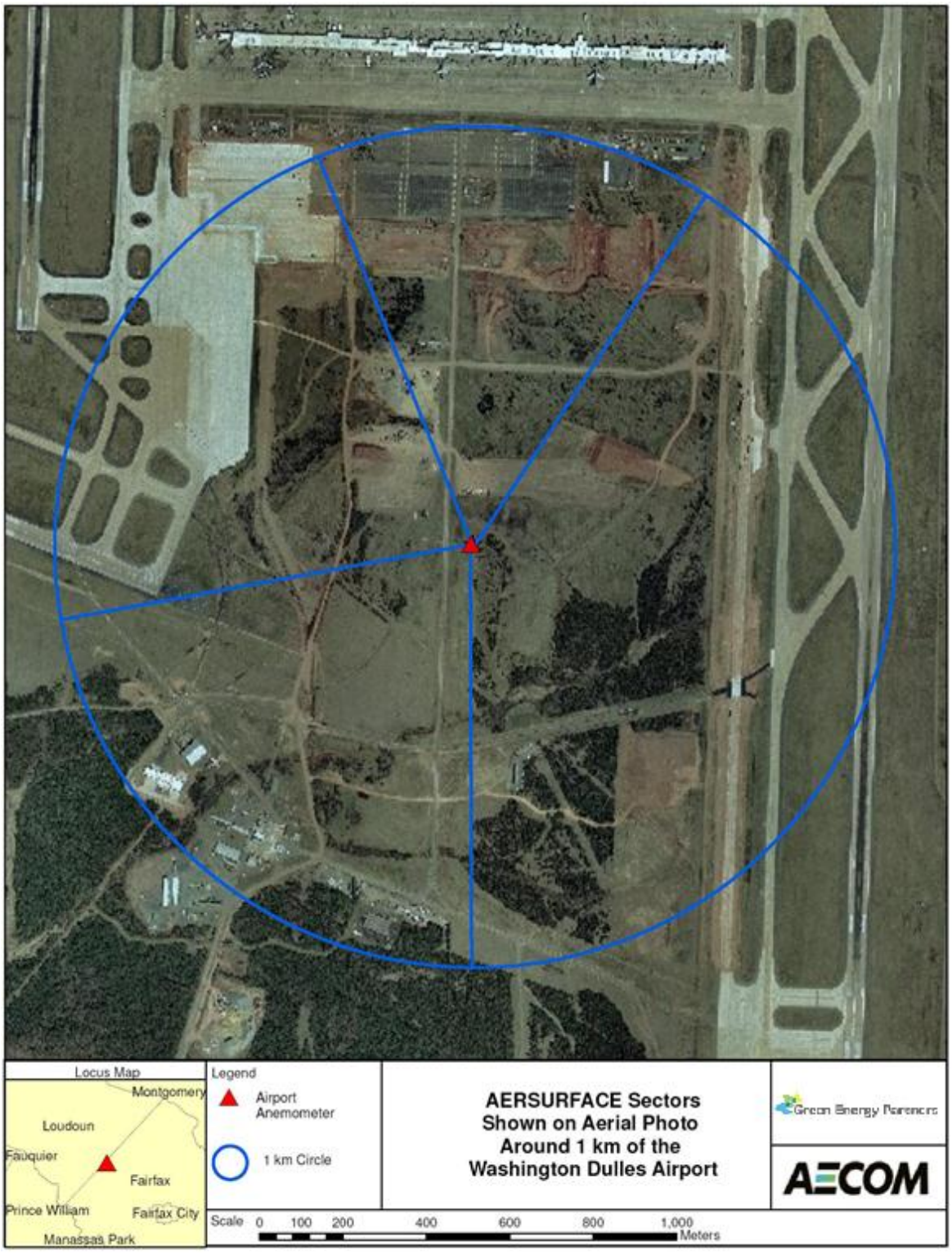

Figure D-7-2 1-km Radius for Dulles International Airport with Surface Roughness Sectors Shown on Land Use Imagery

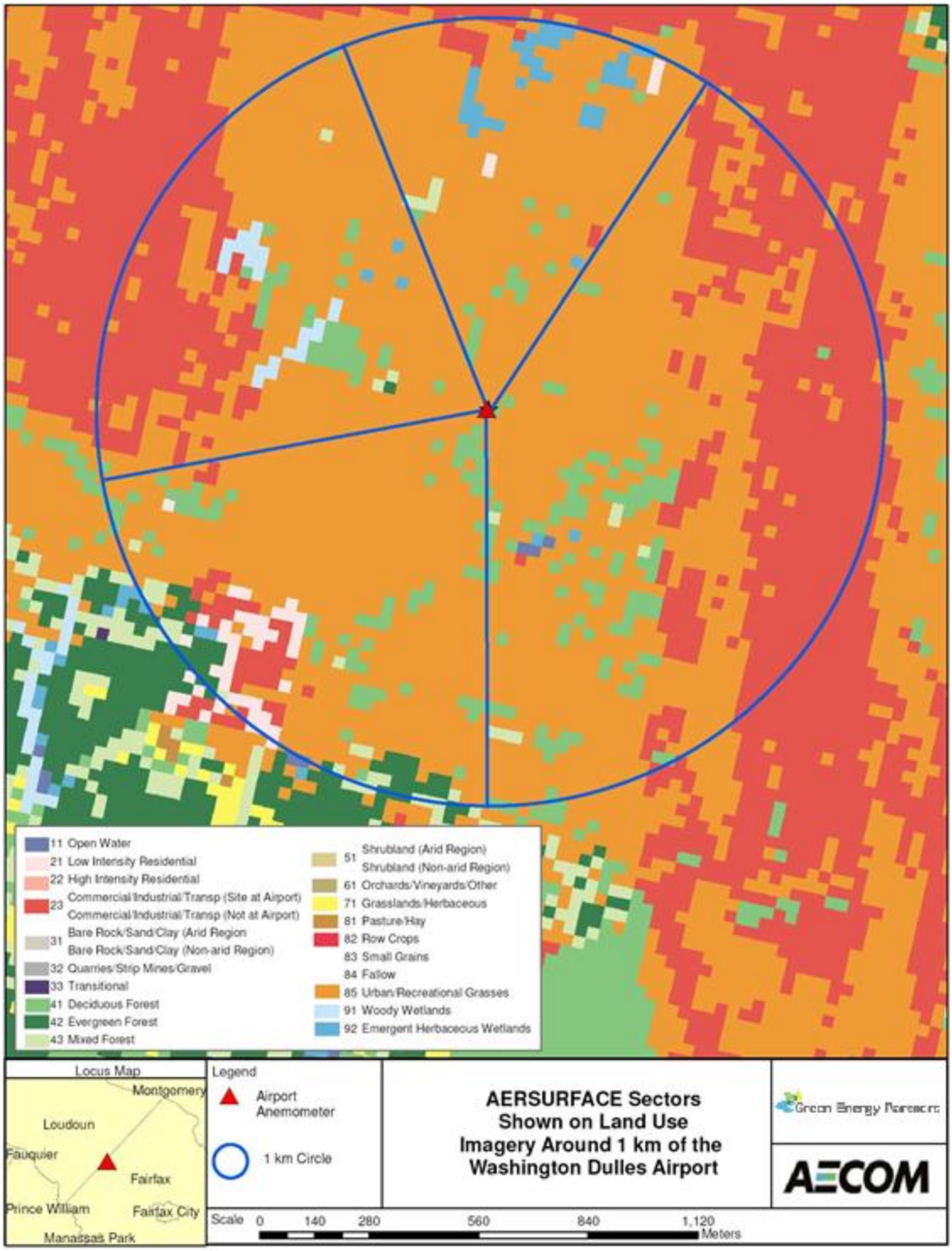

Figure D-7-3 View of Dulles Meteorological Station Looking North

Figure D-7-4 View of Dulles Meteorological Station Looking Northeast

Figure D-7-5 View of Dulles Meteorological Station Looking East

Figure D-7-6 View of Dulles Meteorological Station Looking Southeast

Figure D-7-7 View of Dulles Meteorological Station Looking South

Figure D-7-8 View of Dulles Meteorological Station Looking Southwest

Figure D-7-9 View of Dulles Meteorological Station Looking West

Figure D-7-10 View of Dulles Meteorological Station Looking Northwest